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The Chemical Age

VOL LXI

3 DECEMBER 1949

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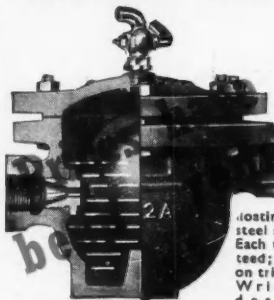
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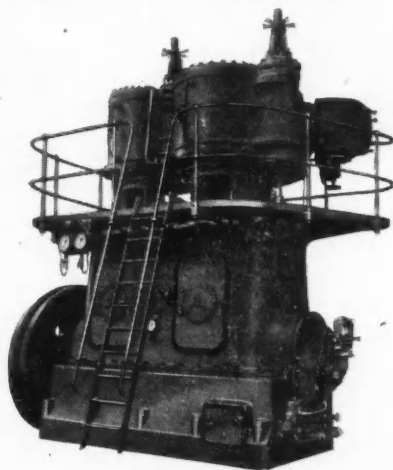
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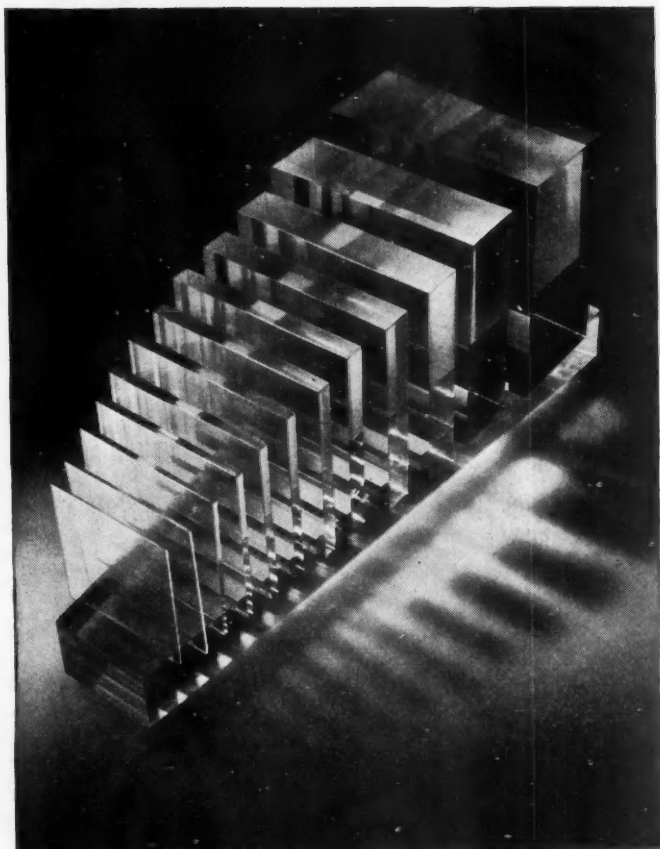
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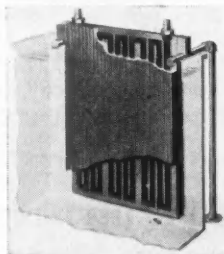
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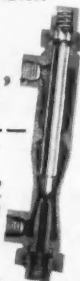
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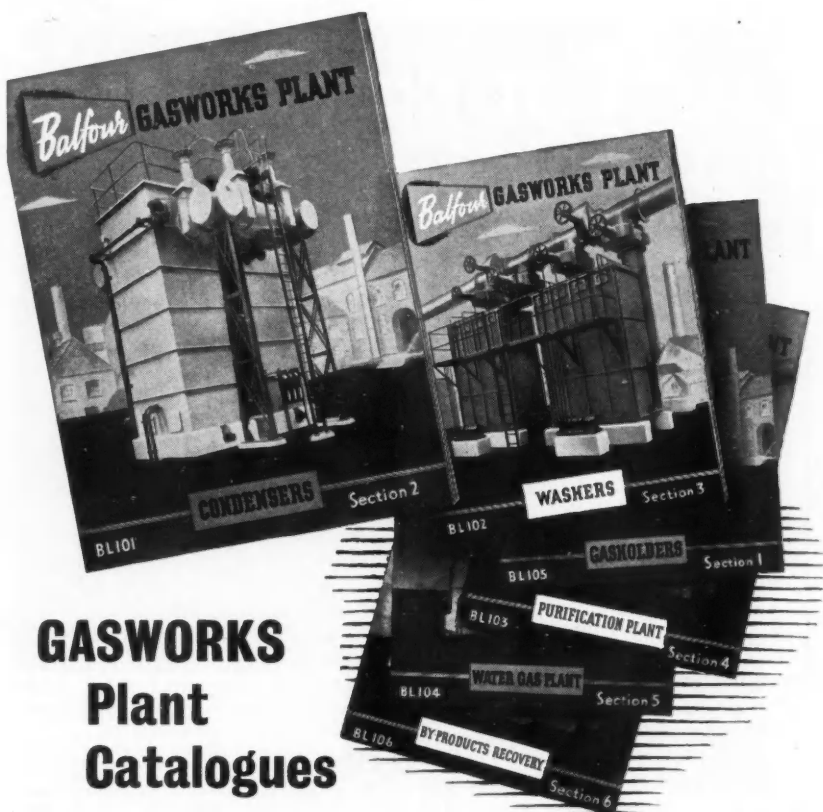
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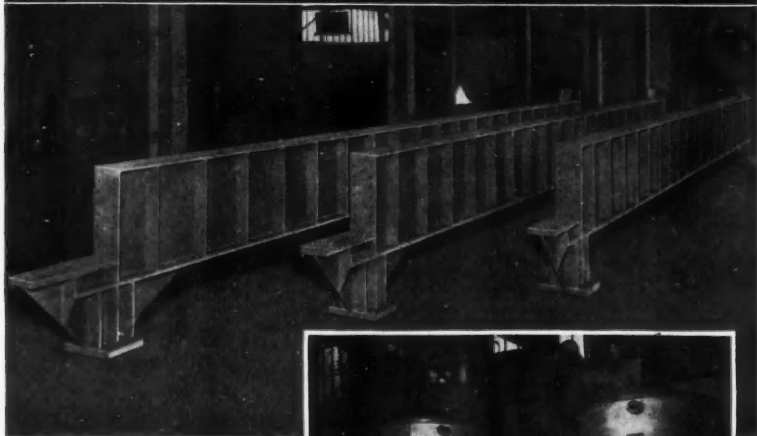
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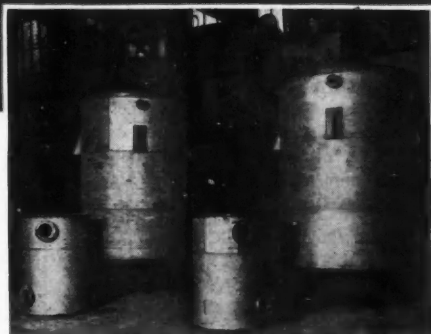
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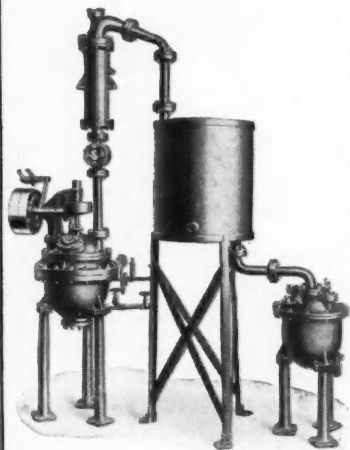


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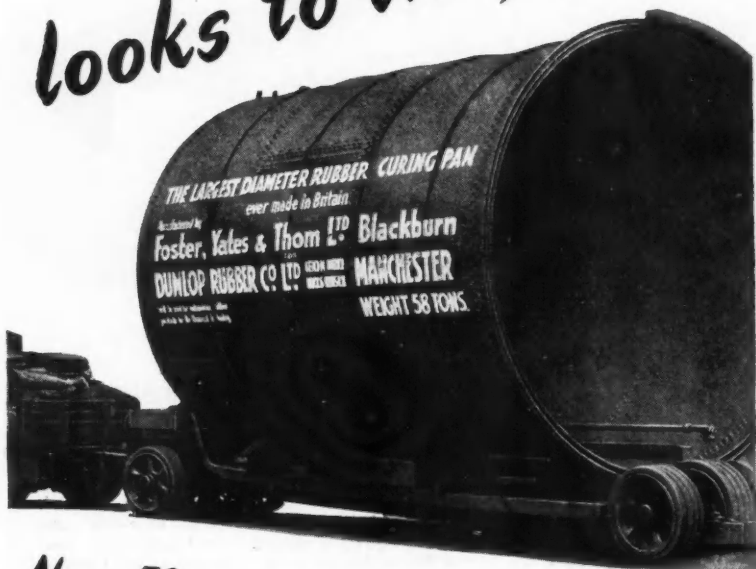
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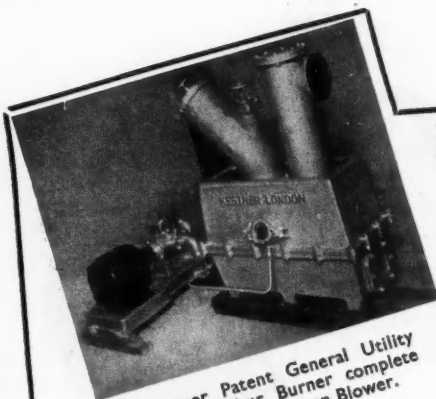
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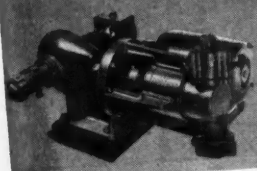
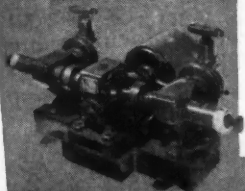
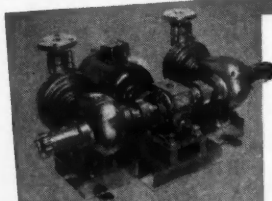
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Volume LXI

3 December 1949

Number 1586

Equipping the Petroleum Industry

THE allocation of \$6.5 million by ECA for the equipment of Grangemouth is a measure of the importance attached in American estimation to the development of Britain's petroleum derivatives industry and, indirectly, of this country's increased ability in a new engineering field. The whittling of the sum originally estimated to be required—\$9 million—takes account of the fact that Britain can supply more plant than was first thought possible. The knowledge that a substantial proportion of that advance will return to the U.S.A. in payment for some forms of oil plant does not diminish the value of that assistance towards meeting the imperative need to cut this country's dollar needs. The rapid progress of the petroleum industry is producing the gradual expansion of production of plant and equipment for refineries, which are becoming progressively less dependent on overseas sources of supply. In the United States the large home market has enabled plant manufacturers to concentrate on specialist lines, while very close co-operation has existed between the petroleum industry and its suppliers. These conditions have given America a very long lead in the design and production of petroleum plant.

When refineries were started in

Britain the companies responsible for these developments had the fairly full collaboration of American associates. British manufacturers had already supplied a fairly large quantity of equipment to the Middle East, but their experience in this direction had been on a fabricative rather than a design and "know how" basis. The tendency, therefore, was to have specialised refinery equipment for Britain built in the United States and shipped to this country for installation. Today the position is changing. Not only have British firms entered the field, but some of the large American concerns, well established in the United Kingdom, are employing British fabricators both for their United Kingdom and export requirements, so that there is no longer quite the same necessity for importing large quantities of equipment from the U.S.A. Some British firms have gone into this new field on an extensive scale, with conspicuous success.

It is not unreasonable or unduly optimistic to conclude that Britain is in process of becoming to an important extent independent in oil refining installations and petroleum-chemical processing equipment of overseas sources of supply, although the petroleum industry must continue to rely on Ameri-

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can technology for some time to come. British manufacturers' present inability to supply certain specialised machinery on a competitive basis results, of course, from the position in the past that limited demand, as compared with that in the United States, has made it impossible to standardise on such equipment.

Beyond doubt, the chemical plant manufacturing industry in Britain is very different from its counterpart during the war. It has gained considerable confidence, has enormously expanded both the quantity and variety of its products, and is doing a job of conspicuous and immediate value. Not only is it playing a very large part in the re-equipment and expansion of the British chemical industries, but it has greatly expanded its export trade. Overseas sales today range from complete plants down to quite small units and some extremely large contracts have been secured. The new home industry, notably at Grangemouth, Stanlow and Fawley, affords a stable nucleus of all this.

Reports from the industry show that, while the labour force has gradually been built up to a fairly satisfactory level, there still remains a rather serious gap in the higher ranks, notably

in the drawing offices. Once a plant has been designed the rest is largely a matter of mechanical engineering, but for the drawing office men with specialised training and knowledge are required. Throughout the engineering industries draughtsmen have become chronically scarce owing to the increased demand, and the problem has been complicated by the wastage during the war, when men abandoned the drawing office for managerial jobs which they now have no wish to leave. The expansion of petroleum processing equally is being hampered by the scarcity of good chemical plant draughtsmen. There is also the familiar shortage of chemical engineers, but the industry has been assisted in this want by the F.E.T.S. courses in chemical engineering. Raw materials are gradually increasing, although there remain some deficiencies, such as of certain thicknesses of mild steel plate.

Generally, it can be said that shortages of technicians and materials, rather than of markets, have become the principal factors limiting the expansion of petroleum equipment engineering. Once these difficulties have been overcome British manufacturers may find fresh scope on a scale seldom equalled in today's markets.

Notes and Comments

Science and the Festival

APPREHENSION that next year's Festival of Britain, in particular the South Bank exhibition in which scientific achievement is to form one of the keynotes, might be weakened by division on political grounds has been allayed by the FBI spokesman, Sir Frederick Bain, one of the festival council, and by the character of some others who will collaborate as advisers, among them Sir Robert Robinson, P.R.S. Reinforcing the answer given by Mr. Hartland Thomas, a member of the presentation panel, at a discussion with the technical Press last week that the council had met with no reluctance to participate fully on the part of either industrialists or scientists, Sir Frederick Bain said there were no grounds for anticipating anything in the nature of a boycott from any section of industry. The Council of Industrial Design, which is largely responsible for the presentation of exhibits selected, makes it clear that this will not be a trade fair, such as the BIF, where industries or businesses can buy display spaces. "A subject qualifying for inclusion must be one in which the British contribution is outstanding—such as an invention like penicillin or the jet engine." In elaboration of this principle, Mr. Hartland Thomas said that manufactures will not be selected; they will select themselves. They must also be illustrative of a particular aspect of the story of British industry. Prestige advertising of a national, but not of a political character would be the keynote of the exhibition and visitors from abroad would be able to follow the development of our industries since their pioneering days. These assurances are welcome and were necessary. Such heavy expenditure at a critical stage in economic affairs of the outcome were anything less than the title of the exhibition claims.

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Water Softening Economics

COUNTRY-WIDE water softening would be a boon to nearly everyone—except perhaps the makers of small-scale softening apparatus—and would fairly certainly repay the very great expenditure by savings in industry and the home. That not altogether arresting conclusion appears to be one of the more tangible results of the painstaking investigations which have been carried on since July, 1946, by a sub-committee of the Central Advisory Water Committee under Lord Walkden's chairmanship. That may appear somewhat obvious; it is certainly more self-evident than the supporting data which this committee has been able to muster from all sources and which are going some day to serve a very useful purpose when country-wide water softening becomes a practicable project. Behind the perfect impartiality with which this report has been prepared is the unexpressed conviction that the ideal of soft water wherever it is lacking in this country—and 43 per cent of the population is computed to be making the best of a hard or very hard supply—is not likely to be realised in present economic conditions. Meanwhile, all the evidence that is needed for the presentation of a good case when the happy moment arrives has now been put on record. Some of it is necessarily not very precise, but is none the less arresting: the estimates that soap waste per person, due to hard water, averages 8.9 lb. (8s. 2d.) yearly and damage to fabrics 10s. Central softening by base exchange, to 200 p.p.m. of hardness, might cost no more than 4d. per 1000 gal., that is about 4s. per head of the population per annum. Even disregarding the saving to industries which do not have their own softening resources (the report does not), the supply of soft water by the mains would be as economical as it would be welcome. But that is not imminent.

Gift of Cortisone

FEW better instances can be looked for of the genuineness of the impulse in some sections of science and technology in the U.S.A. to share some of their advantages than the news of America's impending gift for the use of British research of a small quantity of cortisone, the new "Compound E" which has produced some arresting results in the treatment of rheumatic diseases. It may be assumed that one of the most deserving claimants to some of this specimen material, indispensable to those seeking to provide by synthesis an equivalent procurable in useful quantities, will be the Dyson Perrins Laboratory at Oxford University, where Sir Robert Robinson is to direct the programme of cortisone synthesis research, towards which the Nuffield Foundation has offered the gift of £10,000, spread over three years. The motive of the Oxford undertaking transcends the commercial incentives, but few onlookers can overlook the very attractive rewards which are offered in most of the markets of the world for the newer products of biochemistry research, of which an appreciable supply of any material which could be reliably used to hold in check the crippling effects of arthritis would receive a very large share. That is shown by some of the commercial figures relating to penicillin, of which one producer, Glaxo Laboratories, which is far from enjoying a monopoly, gives some indication. Aggregate overseas turnover of that organisation, not exclusively of penicillin, of course, has doubled in the past two years and is ten times as large as it was pre-war. Total export sales of U.K. penicillin in ten months this year realised £2,139,555 (£1.67 million in the same period of 1948). Research and development applied to a synthetic cortisone could be at least as rewarding. Workers in Sweden, according to the *Lancet*, claim already to have produced almost complete temporary relief of rheumatism effects with a synthetic drug related to one of the natural constituents of the adrenal gland, used in association with synthetic vitamin C.

The complexity of the search is, however, made clear by a warning in the *British Medical Journal* that the substance used in Sweden may be double-edged. Canadian workers hold the view that it is capable of causing arthritis, as well as curing it.

Illicit Drugs

PROGRESS in the international control of narcotic drugs, from the first meeting in Shanghai in 1909 to the Paris Protocol of 1948, has been substantial, though sporadic. The problems in the relentless struggle against the abuse of such drugs—for addiction purposes—have brought into being various international organisations, now numbering eight. Enforcement of a highly complex legislation on a world basis is now the duty of UNO's Commission on Narcotic Drugs, aided by the Economic and Social Council. If evidence were required of the good work already undertaken by the new parent of this problem child, it could be found in the *Bulletin on Narcotics*, the first number of which has been published by the United Nations Secretariat, Lake Success. This 60-pp. booklet is to appear quarterly and will disseminate authoritative information on results obtained in control and on the fight against addiction and describe preparatory work to establish a single convention destined to replace the eight existing organisations. Identifying the country of origin of seized opium is necessarily one of the first requirements for prevention. Opium, the fundamental material of most of the illicit trade, fortunately lends itself to fairly accurate determination of origin by physical and chemical means. The natural product differs greatly in different parts of the world. One of the most important tasks engaging scientists' attention is to determine the origin of prepared opium (for smoking). Given sufficient information about the nature of raw opiums, this, too, is thought to be not insuperably difficult.

START OF UNDERGROUND GASIFICATION

Experiments to Begin Next Month near Chesterfield

THE first attempt to make use of British coal reserves by the underground gasification process is taking shape at Newton Spinney, an opencast coal site near Chesterfield. Drilling, in addition to the exploratory boreholes already cut, is expected to start about the middle of this month. The low-grade coal seam will be ignited and gas may be produced on an experimental scale early in 1950.

The Ministry of Fuel notification announcing this says the experiments will be on a small scale as a preliminary to full-scale work and are designed to discover how the more obvious difficulties may best be overcome. The opencast site was chosen because it provided easy access to the coal seam face. The site is almost unique in having the face of one coal seam already exposed by opencast working and likely to remain so for several months while a lower seam is being worked. This should ensure that the experiments, which will be carried out on the upper seam, will not delay the restoration of the site after the opencast work has been completed. An additional advantage is that the surface over the proposed area is scrub and not agricultural land.

Shallow Deposit

The Fox Earth seam consists of an upper leaf of good coal about 18-in. thick, under which there is dirt inter-banded with thin coal layers, the whole being quite unsatisfactory for mining by normal methods. Up to about 200 ft. in from the actual outcrop this seam (and its overburden) have been removed by opencast working to allow access to a better seam (the Sough) some 50 ft. lower.

There is, therefore, now exposed the coal face of the Fox Earth beneath a maximum of some 40 ft. of overburden. A 4 in. borehole is to be drilled into this face and within the coal seam which slopes downwards. The far end of this borehole, about 250 ft. from the face, will be about 80 ft. below the surface. A vertical borehole will be drilled from the surface to connect to the end of this lateral hole and a second vertical borehole will be drilled also to connect about 50 ft. nearer the exposed face. The lateral hole will then be sealed from this point to the face, leaving a clear channel for air down one vertical, through the coal and up the other vertical.

The coal near the base of one vertical will be ignited and an air draught maintained through the system by a compressor. It is hoped by control of the rate of air flow, and possibly by using steam, to produce combustible gas and sensible heat at the off-take. The gas is likely to be of low grade producer or water gas type.

This first experiment will provide information, additional to that so far obtained from the U.S.A., Belgium and Russia, on which further experiments will be planned, introducing appropriate variants.

Possibilities

When it becomes possible, a separate series of trials will be carried out further from the exposed face to try and establish contact through the coal between two vertical boreholes by pressure without drilling any lateral channel.

The report from the Ministry says it is hoped to turn all the coal into gas, leaving no coke behind. The advent of the gas turbine with its capacity to use low calorific value fuels means that such gas will still be of economic value for the generation of power. This is not to say the experiments now about to start may not yield a high calorific value gas, but to point out that the value of the process will not necessarily be dependent upon this.

If the formidable difficulties can be overcome and means discovered to operate the process under the wide variety of conditions found underground it would become possible to use some at least of the vast masses of coal which by reason of thinness of seam, dirt, or other cause cannot be mined by normal methods. It has been estimated that there is much more coal in this category than in the reserves which can be brought to the surface.

Technologist's Views

At a conference this week, in London, with representatives of the technical Press, addressed by Mr. C. A. Masterman, chairman of the advisory panel on coal gasification, and Dr. A. F. Williams, of the chief scientist's division of the Coal Board, it was strongly emphasised that the present activities were intended to be in the nature purely of a preliminary "laboratory experiment in the open air." It was

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Statutory Prohibition of Smoke Emission?

The Case for Creating Smokeless Zones

SALISBURY has been chosen as the site for smoke trials to be conducted by the Ministry of Supply experimental establishment at Porton, near Salisbury, on and after December 5. Experiments will involve the liberation, in small quantities, of an innocuous smoke, to obtain data on the way in which smoke can be diffused and dissipated in built-up areas. The smoke, which is non-irritant and possesses only a slight smell, will cause no interference to ordinary activities.

In a paper on "The Need for Smoke Abatement," prepared for the Royal Institute of Public Health and Hygiene, on Wednesday this week, Sir George Elliston stressed the necessity for the wise and more efficient use of our fuel supplies. He recalled that a report recently issued by the Federal health authority in Washington on last winter's fatal smoke fog in Donora—when over 20 people died and 40 per cent of the population were made ill—showed that the chief culprit was sulphur dioxide, the corrosive constituent of our own fogs. About the same time, here in London, he said, a week of fog sent up deaths by 20 to 30 per cent over the average for the previous four weeks, while the number of deaths from

bronchitis were more than doubled.

Two-and-a-half million tons of smoke in the form of unburned coal particles were poured each year into the atmosphere. The Fuel Research Station had recently shown that under the conditions of faulty combustion that gave rise to smoke there were heat losses four or five times greater than this in the form of burnable gases—actually crude coal gas—so that altogether the equivalent of 10 million tons of coal or more were wasted yearly as and with smoke. In other words, 2½ weeks' output of the mines each year went—though it did not vanish—into thin air.

The need for new legislation requiring prior approval of new fuel-burning installations, which was now standard practice in the U.S.A. and elsewhere overseas, was referred to by Sir George Elliston. He commended the abolition of smoke by stages through the setting up of expanding smokeless zones—in which the generation of any smoke would be prohibited—as being preferable to any of the more spectacular ways.

(A North-West campaign to encourage the use of smokeless fuel was launched at Liverpool on November 24).

START OF UNDERGROUND GASIFICATION

(continued from previous page)

no more than a beginning, to see if further development work was worth while.

It was the intention to utilise seams of poor coal which, by reason of their low grade, and perhaps inconvenient siting, would not otherwise be exploited. It was certainly not intended to displace any miners from their ordinary work on normal grade coal.

To begin with, a very poor quality gas was expected, because the first intention was to turn it into power, not to use it to feed a gas grid or as a base for chemical products.

As regards possible calorific value of the gas, those working on the scheme would be extremely pleased if by March next a gas even of 50 calorific value were obtained. The gas turbine was not regarded as the ultimate prime user of this underground gas.

The coal gasification panel would in due course make a report to the Scientific Advisory Committee, which would then report to the Minister of Fuel and Power,

with whom would rest the decision whether it was worth while going on with the experiment.

While the resulting gas might be good enough for certain forms of power production, from information which had been received from Belgium and Russia on the work carried out in those countries it was not thought that the quality of the gas was likely to be high enough for "grid" purposes. By very late summer, 1950, however, it might be possible to give some more definite information on this and other technical points.

It had been estimated that by burning 40 acres of one seam, enough power would be obtained to supply Sheffield's needs for one year. It was not anticipated that there would be any interference with agriculture, except that it would be necessary to make occasional, fairly widely separated boreholes.

The scheme bristled with difficulties, but it had immense potentialities. The immediate costs of the undertaking in the next few months were likely to run to about £3000 a month.

VITAL WEST-ZONE PLANTS REPRIEVED

Large Increase of German Oil, Steel and Rubber Potential

IN a statement last week announcing the retention of a number of West German synthetic oil and rubber and steel plants which were to be dismantled, Sir Brian Robertson, chairman for the month of the High Commission, described the agreement represented by the Petersberg pact, which, he said, sought to remove causes of friction between the occupying Powers and the German people.

One of the chief of these causes had been the dismantling of industrial plants, and the Commission felt that in the agreements which members, with the approval of their Governments, had reached in the settlement they had made to Germans a generous contribution; indeed, a maximum contribution.

The ten clauses in the protocol permitting the retention of the rubber oil and steel plants provide for Western Germany's future inclusion in the Ruhr International Authority, gradual re-establishment of German consular and diplomatic services and permission to build ocean-going ships (up to 7200 tons) and certain other vessels.

The dismantling clauses will result in immediate cessation of dismantling at 11 synthetic rubber and oil factories—except for certain research equipment involving "an important security element." These include the Gelsenberg Benzin A.G.

Dismantling at eight steel plants, including the August Thyssen works with a capacity of 2 million tons annually, is also to stop. Non-essential electric furnaces will, however, continue to be removed, as will equipment for producing synthetic

ammonia and methanol from the I. G. Farben plant at Ludwigshafen.

All dismantling will also cease in Berlin—including the Borsig works in the French sector—and work will start again in the factories concerned.

Equipment already removed, except in the case of Berlin, will still be used for reparations. The present restrictions and prohibitions on production will remain; dismantled works may be rebuilt only by permission of the Allied authorities and steel production will continue to be restricted to 11.1 million tons a year.

Sir Brian Robertson, explaining the exclusion of the Salzgitter steel works from the list of plants on which dismantling is to be stopped, said the two principal reasons for refusing the strong request of Dr. Adenauer were that the plant was constructed by Göring specifically to expand the steel industry for war needs and the economic argument for returning the works had not been made out.

He emphasised that it was not intended that this agreement should be regarded as a stepping stone for further demands. The Occupation Statute was due for review in the autumn of next year, and the programme now launched was to cover the period between now and then. The Federal Chancellor had given an assurance that his Government would use its influence and authority to ensure that the balance of the dismantling programme proceeded expeditiously without obstruction.

Italy Exploring New Use for Methane Gas

AN interesting experiment in the use of methane gas in the production of Portland cement has been made by the firm of Rossi, near Piacenza, Italy. This undertaking possesses one of the longest rotating kilns in the country (90 m.) which has hitherto functioned on pulverised coal.

Technicians of the company, seeking to replace coal by methane, were faced initially with the problem that methane gives a long flame instead of the short yielded by coal. There was, moreover, always the danger of methane forming a detonating mixture. A number of measuring instruments had to be devised before the gas was admitted into the kiln, at the pressure of $1\frac{1}{2}$ atm.

The crushed limestone was introduced into the kiln and subjected to a temperature of 1200-1400°C. As the inclined cylinder rotated, the limestone descended gradually to the bottom, fusing to become clinker ready for milling.

A careful checking of the processing cycle has shown that from the technical point of view the idea is acceptable. It remains now to see whether the process is satisfactory from the point of view of cost. Even if the use of methane is slightly more expensive than that of coal, the process seems likely to be adopted in Italy, as the extra cost might well be compensated by technical convenience.

FLOTATION APPLIED TO CHEMICAL SEPARATION

Potential Use of Hydrophobic Films*

FLOTATION as a means of separation and concentration of minerals has become almost traditional and most of the work so far published in technical literature covers that aspect of flotation.

The employment of flotation as a means of separation of chemical products is, however, practicable. There is indeed a wide field of application, and the process need not be confined to the mineral salts.

Essential Conditions

Practically all the inorganic and organic products, independent of their chemical composition, are floatable, providing that the following conditions are fulfilled:—

1. It is necessary that the substances being treated should be solids and, if possible, crystallised.

2. The two compounds to be separated should not be too intimately aggregated; in all cases it is necessary that they should be capable of being separated by grinding.

3. The non-floating product must have a specific gravity higher than the density of the solution.

4. The solubility of the products should not be so great as to give the pulp a viscosity which would endanger the operation.

It is useful to predict, and to calculate in advance, the flotation conditions for each product, starting with its chemical, physical and mineralogical properties. Great progress has already been realised in this direction, but there is still much to learn. The more the theory of flotation is examined, the more clear it becomes that a large number of factors intervene in the result and exert influence on the floatability and separation of the mixture.

The problem is not only to determine the factors which condition the floatability of a pure product under the influence of certain reagents, but also being able to differentiate the degree of floatability of two or several bodies constituting a mixture.

The most important factor is the aptitude of a body to be wetted, depending on the equilibrium of interfacial and super-

ficial tensions, on the one hand, between the mineral and the water; and, on the other hand, between the mineral and air.

Although the wetting aptitude of a body may be low, it is necessary that the interfacial tension between the mineral and water should be high, and that between the mineral and air very small. In these conditions, the surface of the body becomes hydrophobic, and aerophilic.

It is not possible to measure directly the interfacial tension between the mineral and water, any more than that between the gas and the mineral; but according to Young's theory, the extent of the contact angle constitutes a measure of the wetting aptitude of a body. The greater the contact angle is, the more the body is hydrophobic.

Interfacial tensions can be influenced by the flotation reagents. These, particularly the collective reagents, are absorbed selectively by the minerals being floated. They comprise heteropolar substances. The active groups of these heteropolar molecules attach themselves to the mineral, while the inactive parts, which are most often the hydrocarbon groups, orientate themselves towards the solution and form a new hydrophobic surface.

The properties required of a reactive collector may be defined by the following characteristics:

It should be heteropolar; it is necessary for it to be absorbed selectively; and one of the groups should attach itself to the surface of the mineral and should be chemically inert as regards the liquid.

Hydrophobic Film Formation

The formation of a hydrophobic film on the mineral to be floated is the most important condition; in addition, however, it is indispensable that a foam should also be formed, which should be sufficiently stable to the surface of the liquid where it is elevated simultaneously with the floated mineral.

In differential flotation, where different minerals are being separated, with regard to their surface properties, it is sometimes necessary, in addition, to use modifying reagents. These secondary reagents form hydrophilic complexes at the surface of certain minerals and impede the flotation; they function as suppressing agents. The

* "The Separation of Mineral and Organic Products by Flotation," by Dr. A. Guyer (*Chimie et Industrie*, Vol. 62, No. 2).

influence of these reagents may be permanent or temporary and can be annulled by re-activators.

In these flotation tests, pure water, which is the traditional suspension medium in mineral flotation, was replaced by a saturated solution of salts, which take part in the flotation. Because of this, the wetting aptitude of bodies changes, and the viscosity, modified by the dissolved salts, also exerts influence on the quality of the foam produced.

In preparing the materials by grinding, it is first necessary to find the optimum fineness of the salts. If the two salts are represented by a very intimate aggregate of crystals, it is essential to grind to a high degree and the flotation has to be adapted to the fineness obtained.

In industrial chemistry it is often necessary to deal with a mixture of two pure salts. In this case, there is the possibility of adapting the grinding to the requirements of the flotation process, and it is confirmed that there exists, in each of the cases, a well defined optimum fineness.

As regards the influence of the solubility of salts on the flotation, a soluble salt exhibits a bad flotability, while flotability will be good for a slightly soluble salt. This supposition can be verified in practice; it is in this way that potassium sulphate, which is slightly soluble, floats better than potassium nitrate. There are, however, frequent exceptions to this rule; alkaline salts, for example, float better than the alkaline earth salts, which are less soluble.

The solubility of the salt has only an indirect influence; it manifests itself on the liquid by modifying the viscosity, the pH, the surface tension, and even the solubility of the flotation reagent. The viscosity of a solution of magnesium chlor-

ide, for instance, is thirteen times greater than that of pure water.

Care must be also taken to ensure that the salts dissolved in the pulp do not enter into intimate reaction with the flotation reagents. Barium salts and the sulphonated aliphatic alcohols are a case in point.

Working at a controlled temperature is very important, because a temperature change can exert influence on the reaction collecting reagents and the foaming agents. Generally, the operation is conducted at normal temperatures, but sometimes there is an advantage in lowering the temperature towards 0°C., provided that the liquid does not become too viscous under these conditions. When soaps are employed, it is necessary to measure them out with great exactitude.

The influence of the air introduced into the pulp by mechanical or pneumatic aeration should not be overlooked. Regarding the necessary dimensions of the gas bubbles, it has been confirmed that a diameter of about 0.5 mm. is sufficient to entrain crystals of about 0.25 mm.

Dimension of the bubbles should normally be above this minimum value, but it should also be remembered that a single bubble supports, not only one particle of salt, but several. On the other hand, it is necessary to avoid too large a bubble size, because the stability of the foam produced would not be good. The size of the bubbles is also strongly influenced by the necessary agitation of the pulp, and it is accordingly impossible to calculate in advance the aeration filler pores. In practical tests, good results have been obtained with a pore size about 0.1μ.

The tables below give some test results obtained with inorganic salts.

Separation problems of organic compounds are frequently encountered in

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TABLE I. SEPARATION OF MIXTURES OF SALTS OF THE SAME CATION

Mixture 1:1	Reagent Sodium Oleate kg. per ton	Concentrate per cent.	Residue per cent
$K_2SO_4 + KCl$	1.2	95.6 K_2SO_4	98.9 KCl
$K_2SO_4 + KNO_3$	1.0	92.1 K_2SO_4	92.7 KNO_3
$KNO_3 + KCl$	2.0	95.7 KNO_3	76.2 KCl
$NaNO_3 + NaCl$	3.0	86.2 $NaNO_3$	81.1 NaCl
$Na_2SO_4 + NaNO_3$	3.0	88.0 Na_2SO_4	58.1 $NaNO_3$

TABLE 2. SEPARATION OF MIXTURES OF ALKALINE SALTS AND ALKALINE EARTH SALTS

Mixture 1:1	Reagent Utinal V kg. per ton	Yield per cent	Concentrate	Purity per cent
$NaNO_3 + Ba(NO_3)_2$	0.05	39.2 $NaNO_3$		96.9 $NaNO_3$
	0.1	74.6 $NaNO_3$		93.9 $NaNO_3$
	0.2	91.8 $NaNO_3$		91.1 $NaNO_3$
$BaCl_2 \cdot 2H_2O + NaCl$	0.05	70.7 $BaCl_2 \cdot 2H_2O$		93.9 $BaCl_2 \cdot 2H_2O$
	0.1	80.1 $BaCl_2 \cdot 2H_2O$		—
$(NH_4)_2SO_4 + CaCO_3$	0.01	29.9 $(NH_4)_2SO_4$		99.7 $(NH_4)_2SO_4$
	0.03	88.5 $(NH_4)_2SO_4$		99.1 $(NH_4)_2SO_4$
$(NH_4)_2SO_4 + CaSO_4$	0.015	46.9 $(NH_4)_2SO_4$		98.8 $(NH_4)_2SO_4$
	0.03	96.1 $(NH_4)_2SO_4$		96.2 $(NH_4)_2SO_4$

The Higher Diols

New Industrial Uses in a Wide Field

From A SPECIAL CORRESPONDENT

HOMOLOGUES of ethylene glycol and propylene glycol are now assuming considerable industrial importance in many different fields. The most promising of the newer diols are butanediol, pentanediol, hexanediol, methyl pentanediol, ethylhexanediol, methoxymethyl dimethyl pentanediol and ethoxymethyl dimethyl pentanediol. As a class, these are colourless, stable, hygroscopic liquids of low volatility which have excellent solvent properties for dyes, printing inks, essential oils and various gums and resins. Except for ethylhexanediol and ethoxymethyl dimethyl pentanediol, the diols are completely miscible with water and the lower alcohols.

These new compounds are of special interest for the manufacture of plasticisers, resins and emulsifying agents; the higher diols readily form diesters possessing valuable plasticising properties. When used in concentration between 15 and 25 per cent by weight, methoxymethyl dimethyl pentanediol is of particular value as a plasticiser to improve the milling, moulding and casting characteristics of nylon plastics.

Butanediol-1,3 (butylene glycol) is less volatile and more viscous than its lower homologues and is more suitable for use as a humectant, plasticiser for casein, zein, regenerated cellulose film, gelatine and cork, etc., and for special lubricating applications. Pentanediol-2,4 or amylene glycol is a definite crystalline compound melting at 45°C. and soluble in water to the extent of 87.9 per cent by weight at 20°C. This diol is useful in the manufac-

ture of water-bound paints and for the preparation of emulsions, soluble oils, greases and wood stains.

Hexylene glycol or 2-methyl pentanediol-2,4 is used as a solvent and coupler in textile oils, paper coatings, printing and duplicating inks, leather finishing oils, and dressings. The most viscous of the diols is hexanediol-2,5. This has a boiling point 69° lower than that of glycerol, but viscosity 37 centipoises higher. It can be dehydrated on heating with mineral acid to dimethyl tetrahydrofuran.

Octanediol or 2-ethylhexanediol-1,3 was the first glycol to be produced having limited water solubility. It is durable and a highly effective insect repellent against mosquitoes, biting flies, gnats, chiggers and fleas. Resembling glycerol and propylene glycol in its lubricating action on the skin, this diol is a useful additive for cosmetic creams. The substituted 1,5-pentanediols combine the chemical characteristics of glycols with glycolesters. The ether linkage confers unique solubility characteristics which suggest their use as coupling agents and as solvents for brake fluids, duplicating fluids, cleaning compounds, adhesives and dyes.

It needs to be borne in mind, however, that, as a family, the new diols are intended primarily for industrial applications and should not be used in products intended for external or internal use, either alone or in combination with other materials, until it has been clearly established that the final product is safe for the purpose intended.

FLOTATION APPLIED TO CHEMICAL SEPARATION

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industrial chemistry. The problem of flotation separation applied to organic compounds is obviously different from that for mineral products. Nearly all solid organic products are more or less hydrophobic.

Good results are obtained by seeking to render the body more hydrophilic in a specific and differential manner. The floatability of organic compounds was found to be fairly different and could be considerably modified, not only by the choice

of reagent, but also by the amount used. Table 3 gives some test results obtained.

TABLE 3. SEPARATION OF MIXTURES OF VARIOUS ORGANIC COMPOUNDS

Floating Mixture	Remaining	Concentrate	
		Yield per cent	Purity per cent
Naphthalene	Phthalic acid	94	94
Phenanthrene	Phthalic acid	65	98
Anthracene	Phthalic acid	25	96
Acenaphthene	Phthalic acid	49	85
Salicylic acid	Phthalic acid	88	65
Salicylic acid	Antraquinone	70	70
Benzoin	Antraquinone	70	84
Salicylic acid	Oxalic acid	89	93
Succinic acid	Oxalic acid	67	95
Phenanthrene	Succinic acid	39	88
Acetanilide	Pentaerythrite	88	97

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FLUORESCENT MATERIALS FOR TEXTILES

The Wave Mechanics of Light Absorption

by R. W. MONCRIEFF

THE application of fluorescent materials to textiles has opened up new possibilities in respect of degree of brightness and purity of shade in which yarns and fabrics can be produced. It is true that a few fluorescent dyestuffs have long been used because of the brilliance of shade that they would give; for example, Rhodamine B has been without a peer for the purity and brightness of the pink shades that it would give on wool, but the deliberate application of fluorescent materials simply because they are fluorescent and the application of colourless fluorescent materials to textiles, are comparatively new developments.

Bowen¹ has discussed the subject of fluorescent materials according to the ideas of wave mechanics. The absorption of light by a molecule is represented as the passage of an electron from one orbital to another of higher energy, i.e., when the molecule absorbs the light its potential energy is increased. The transition to the higher state of energy takes place very rapidly, in about 10^{-15} sec., and in its higher energy state both the vibrational and the electronic energy of the molecule are increased.

Chemical Change

Then the molecule collides with other molecules, e.g., of water if it is in solution, and in most cases (non-fluorescent substances) is robbed in a period of less than 10^{-8} sec. of its extra vibrational and electronic energy by collisional effects and internal deactivation or by chemical change. The excited molecule (excited because it has absorbed light) is unstable and its extra energy is lost for the reasons just given, i.e., it is dissipated as heat.

But some substances have a peculiarly resistant, stable, upper electronic level, and these (fluorescent) substances after their transition to a higher energy level, although they soon (10^{-12} sec.) collide with water molecules and lose their extra vibrational energy to them because their vibrations slow down due to repeated collisions, do, however, retain their extra electronic energy, of which the water molecules are unable to rob them.

The excited molecules tend to return to their original potential energy in an

average time of about 10^{-8} sec. They can do this only by losing energy in some way, and as the water molecules cannot relieve them of this energy they re-radiate it as light of lower frequency than that which they absorbed. Only molecules which have a peculiarly resistant, stable, upper electronic level are, in fact, fluorescent.

In the main these substances belong to two classes. The first are substances composed of molecules containing transitional elements or rare earths, or inorganic complexes such as uranyl UO_2^{++} and platinumocyanide $\text{Pt}(\text{CN})_4^{--}$ where the electron which has transferred to a higher energy orbital is deep in the atomic shell and is not a valency electron; it is accordingly protected by its outer electrons from the consequences of the collisions which the molecule undergoes. The second class comprises organic compounds with conjugated systems of π electrons where the excitation of a π electron to a higher level has only a small influence on the structure and stability of the molecule.

Electronic Energy

A comparatively few substances are retentive of their extra electronic energy; they do not part with it to colliding molecules, but dissipate it in vibrations as light, i.e., they are fluorescent. Therefore, only those substances which are singularly retentive of a higher energy state show fluorescence. Such substances are either those containing a heavy inorganic complex in which the excited electron is deep in the shell, or else are organic compounds with a conjugated electronic structure; this last group includes some dyestuffs and the new optical bleaches.

Notable Features

Features that may be noted are: The fluorescent light is of smaller frequency (longer wave-length) than the absorbed light, for the reason that some of the absorbed energy has been transformed to increased vibrational energy which has been lost in collisions. Fluorescent materials when they are exposed to ultra-violet (high frequency short-wave length) light fluoresce with light in the visible spectrum, i.e., light of lower frequency and longer wavelength.

Fluorescence is exhibited only by molecules whose electronically excited state is very resistant to collisions. The fluorescence spectrum is largely independent of the absorbed light, for if the absorbed light has a higher frequency more energy as vibrational energy will be lost by collisions.

The increase in the electronic energy due to the transition of an electron to an orbital of higher energy will be the same, irrespective of the frequency of the absorbed light. Therefore the energy that has to be dissipated as re-emitted light (fluorescence) will be largely independent of the frequency of the light absorbed.

Wide Range of Uses

Fluorescent materials are fairly widely used, apart from their recent application to textiles. Those incorporating heavy metals, e.g., tungstates, are used as X-ray viewing screens. Similarly, the viewing screen of television sets is illuminated by fluorescent materials; the viewing screen is a cathode-ray tube painted with a fluorescent compound.

Those organic fluorescent agents, which are colourless, can be used not only as optical bleaches but also as invisible ink, which becomes visible when it fluoresces on exposure to ultra-violet light.

Although daylight is rich in ultra-violet light, it is convenient to have in a laboratory engaged on work on fluorescent compounds a source of ultra-violet light substantially free from visible light. The G.E.C. "Osira" lamp which, with auxiliary apparatus including a choke, can be run off an electric light socket, is convenient for this purpose. The bulb is dark in colour and takes a minute or so after being switched on to warm up, but when it has warmed up its "light" causes fluorescent materials to glow brightly and enables rapid appraisal of fluorescent properties to be made.

Rhodamine B

Yarn that has been dyed with Rhodamine B glows brilliantly under such a light. The light is useful, too, for differentiating between mineral and vegetable oils; the former usually glow brilliantly, the latter not at all, or only weakly. Probably this behaviour is due to the greater unsaturated content of the mineral oils.

Some curious personal effects can be noted under the radiation from such a lamp. A grease spot on the clothes will often glow; hair to which an oil dressing

has been applied may shine vividly in the darkness; lipstick containing rosin or some such fluorescent colouring matter will be particularly vivid, and so will finger nail varnish; false teeth, too, are readily distinguished from natural.

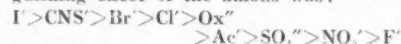
Fluorescence depends on the retention by the molecule of the increased electronic energy, despite frequent collisions with other molecules. Molecules of some substances are more greedy for this extra energy than others. Because water molecules are unable to rob the molecules of a fluorescent material of its extra electronic energy, it does not follow that molecules of other substances share this inability. In fact, other kinds of molecules will rob the excited molecules of their extra electronic energy, dissipate it as heat, or as chemical energy, and so inhibit fluorescence.

It has, too, been found that fluorescent substances will sometimes photo-catalyse or photo-sensitise a reaction, and when they do this the energy which is ordinarily lost as fluorescent light is used instead to start a chemical reaction and the fluorescence is lost.

Quinine Bisulphate

Jette, West and Müller² investigated the inhibiting action which some substances have on fluorescent solutions. They experimented with quinine bisulphate, with the sodium salt of fluorescein and with uranyl sulphate, all of which are fluorescent. They found that the decomposition of a solution of glucose was sensitised by the presence of light-activated uranyl sulphate, but that glucose extinguished the fluorescence of uranyl sulphate. The energy that uranyl sulphate has available for fluorescence, if used for photo-sensitising a reaction is no longer available and fluorescence is extinguished.

Many salts inhibited fluorescence, and in nearly every case it was the anion that was responsible. The order of the extinguishing effect of the anions was:



Thus, iodides show the maximum extinguishing effect of fluorescent solutions, then thiocyanates, then bromides, and so on. If, therefore, a fluorescent substance is to be applied to a textile material, care must be taken that no substance which will extinguish the fluorescence is present.

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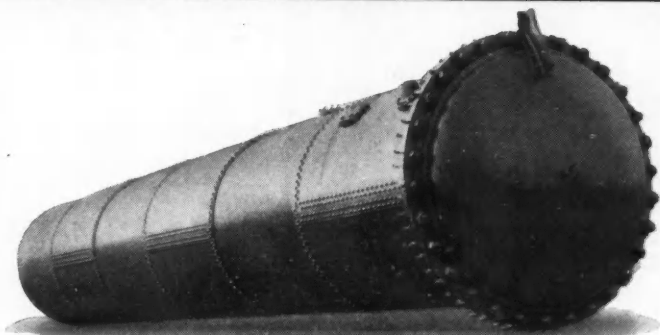
- 1 E. J. Bowen, *Quarterly Review*, 1947, 1, 3-15.
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(To be continued)

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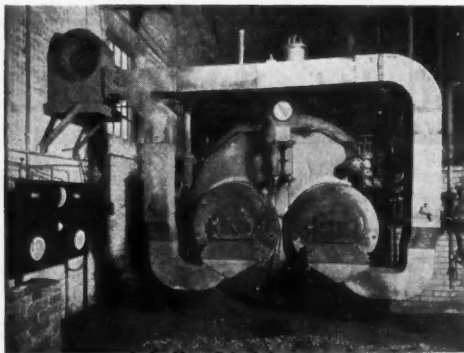
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Metallurgical Section

3 December 1949

Corrosion Resisting Steels

Qualitative Review of Grades for Chemical Industry

by J. A. McWilliam, T.D., M.A.

THE term "corrosion-resisting steels" is used in preference to the more common "stainless steels," because no metal can be described as stainless under all corrosive conditions.

Corrosion-resisting steels have now been in use for the manufacture of chemical plant for some 25 years, and even as far back as 1929, Hatfield¹ read a paper to the Institution of Chemical Engineers entitled "The Fabrication of Acid-Resisting Steel Plant." This dealt comprehensively with the fabrication of the 18/8 steels which were available at that time.

There are many different qualities of corrosion-resisting steels, and each has its own particular use; this is a point which should be recognised not only by designers, but also by management and foremen engaged in plant operation and maintenance. Even today the term "stainless steel" is often seen on blue-prints

when the exact quality of steel should have been specified.

Hatfield,² in 1942, in his lecture on acid- and heat-resisting steels, given to the Institute of Chemistry, divided the corrosion-resisting steels into three groups:

(1) Plain chromium steels (12/20 per cent chromium) with different carbon contents.

(2) High chromium, low nickel steels (16/20 per cent chromium with 2.5 per cent nickel).

(3) Austenitic chromium-nickel steels, with or without additions of special elements such as tungsten, titanium, columbium, molybdenum and copper.

Typical analyses of steels of groups 1 and 2 are shown in Table I, and those in group 3 are shown in Table II.

The FI quality is a straight chromium steel with low carbon, sometimes referred to as stainless iron. It is resistant to mild corrosive conditions and, therefore, does not find extended use in chemical plant. FCI quality has, in addition, sulphur and molybdenum contents to impart free-cutting qualities. The free-cutting straight chromium types of stainless steel are much more readily machined than the ordinary types of stainless steel, and this is a great boon, particularly in the production of parts on automatic machines.

The FI17 type is one in which the chromium has been increased to 17 per cent and the carbon retained at 0.10 per cent. The additional chromium imparts a certain increase in the resistance to corrosion, but this steel does not have as good resistance to corrosion as the austenitic steels in group 3.

The FG type has a higher carbon content than the two previous steels, and so can be hardened to give higher mechanical properties, FCS being a free-cutting variety of the FG steel.



Argonarc welding Staybrite tubes to a header plate. Tubes and plate are both of FDP grade of non-corroding steel

* Abstracted from the paper presented before the Institution of Chemical Engineers, at Birmingham, on November 26.

Where a very high degree of hardness is required, the FHM quality is used, and it will be noted that this has increased carbon and chromium contents, and in order to maintain the resistance to corrosion 0.50 per cent of molybdenum is also added.

S80 steel is of particular value to the aircraft industry as it combines excellent mechanical properties and improved corrosion resistance compared with the steels in group 1. It is normally supplied with a tensile strength of 50/60 tons p.s.i.

It will be noted that the steels in group 3, as well as containing high chromium, also contain substantial quantities of nickel; the FST quality is the original 18 per cent chromium, 8 per cent nickel type of steel which is the basis of all the steels shown in Table II. This steel is known throughout the world, and is commonly referred to as "18/8" steel. While all the steels in Table II are capable of being welded, the author does not recommend the welding of FST steel except where the corrosive conditions are particularly mild, as, for example, on light gauge sheet for decorative trim. The reason for this will be explained later and, of course, FST should not be used for welded work in chemical plant.

The FDP type is one which has probably found the most extended use in chemical plant, and it will be noted that this is similar to FST, but with an addition of titanium. The EMS quality is an easy machining variation of FDP steel, in which sulphur and molybdenum have been added to impart easy machining properties. While the machining of this type cannot really be described as free-cutting, it is, however, much more readily machined than the other 18/8 steels.

In the FSL quality it will be noted that the carbon has been reduced to 0.05 per cent which, in this case, is a maximum. The content of the chromium has been raised to 19 and the nickel to 10 per cent. This steel is very suitable for the production of cold pressings, as it is less susceptible to work hardening than the other qualities shown in Table II and, therefore, it can be recommended where severe cold-forming operations have to be encountered. It is suitable for welding.

It will be noted that FCB quality is very similar to FDP, but contains columbium instead of titanium. This quality is also particularly to be recommended for welded work of all kinds. Where resistance to scaling at high temperatures is required, this steel can safely be used up to 800° C.

FML steel has a small addition of molybdenum, which increases its resistance to corrosion compared with the steels previously mentioned. It has, however, a somewhat limited application; where corrosive conditions are too severe for FDP or FCB steels, most users prefer to come to the FMB quality, which has a molybdenum content of about 2.75 per cent. This imparts an even greater resistance to corrosion, as will be shown in the corrosion tables later in this paper.

For the production of large plates for heavy chemical plant made from molybdenum-bearing 18/8 steel, the addition of titanium has been found desirable, and the FMB Ti steel contains about 2.75 per cent molybdenum, together with 0.3 per cent titanium.

The "254" quality is the most recent quality developed by the author's company (*Firth-Vickers Stainless Steels, Ltd.*) and put on a commercial basis. It will be noted that this is a low carbon steel

TABLE I

		Group 1						Group 2
		FI	FCI	FI17	FG	FCS	FHM	
C.	%	0.10	0.12	0.10	0.25	0.18	0.80	0.16
Si.	%	0.20	0.60	0.20	0.25	0.60	0.20	0.20
Mn.	%	0.20	1.20	0.20	0.25	1.20	0.20	0.20
Cr.	%	13.50	13.50	17.0	13.50	13.50	17.0	16.50
Ni.	%	—	—	—	—	0.25(max.)	—	2.50
Mo.	%	—	0.28	—	—	0.28	—	—
S.	%	—	0.23	—	—	0.23	—	—

TABLE II

		Group 3							
		FST	FDP	EMS	FSL	FCB	FML	FMB	FMB Ti
C.	%	0.12	0.12	0.12	0.05	0.12	0.07	0.07	0.07
Si.	%	0.60	0.60	0.80	0.50	0.60	0.60	0.30	0.45
Mn.	%	0.30	0.40	1.60	0.40	0.40	0.30	0.50	1.50
Cr.	%	18.0	18.0	18.0	19.0	18.0	18.0	18.0	17.50
Ni.	%	8.0	8.0	10.0	10.0	10.0	9.5	8.0	9.0
Ti.	%	—	0.60	0.60	—	—	—	—	0.30
Mo.	%	—	—	0.28	—	—	1.25	2.75	2.75
S.	%	—	—	0.25	—	—	—	—	—
Cb.	%	—	—	—	—	1.20	—	—	—
Cu.	%	—	—	—	—	—	—	—	2.40

containing 18 per cent chromium, 18 per cent nickel, 0.6 per cent titanium, 3.75 per cent molybdenum and 2.4 per cent copper. In common with the other qualities in Table II, this steel is capable of being welded by various methods, and it can be formed in a similar manner to the FMB quality. Electrodes for the electric arc welding of "254" are now available as a standard product.

The most important feature about this steel is its excellent resistance to corrosion; it is superior to all the other qualities shown in Table II, and shows good resistance to sulphuric acid of many concentrations and temperatures.

The physical and mechanical properties of "254" steel are as follows:—

TABLE III

Physical Properties	
Specific Gravity 8.04, equivalent to	501 lbs./cu. ft.
Modulus of elasticity (softened condition)	13,000 tons/sq. in.
Specific heat	0.12 (cals./°C./gram)
Thermal conductivity at 20° C. (c.g.s. units)	0.031
Electrical resistivity at 20° C. (microhms per cm. cube)	85
Coefficient of thermal expansion, 20-100° C.	.000017 per °C.
Magnetic Properties	
Permeability in fully softened condition	1.005 to 1.03
Typical Mechanical Properties	
	Normal heat-treated condition
Yield point	18 tons/sq. in.
Max. stress	39 tons/sq. in.
Elongation	47 per cent.
Reduction of area	66 per cent.
Brinell hardness No.	160
Izod impact	80 ft. lb.
Fatigue limit (10,000,000 reversals of stress unbroken)	17 tons/sq. in.

As chemical plant made from corrosion-resisting steels is usually fabricated by welding, the weldability of these steels

is of the greatest importance. With the original 18/8 steels it was found that if they were heated in the range of temperature from 400° to 850° C., carbide precipitation took place along the crystal boundaries. The crystal boundaries became less resistant to corrosion, and subsequent contact with corrosive media produced intercrystalline corrosion.

The consequence was that on either side of a weld there was a belt of metal liable to suffer from intercrystalline corrosion. In order to restore the welded plant it was necessary to heat-treat by cooling quickly from 1050° C. Such treatment was not feasible on bulky or complicated plant, and this disability was overcome by the development of 18/8 steels stabilised with titanium, columbium or molybdenum.

These stabilising elements prevent carbide precipitation and intercrystalline corrosion. Fig. 1 shows an electric arc weld on some equipment where the corrosive conditions required the use of the molybdenum-bearing 18/8 type of steel. Analysis showed that the sheet which resisted the severe corrosive conditions was, in fact, the molybdenum-bearing 18/8 type, but that the sheet on the other side of the weld was an unstabilised 18/8 steel. It will be noted that the latter steel has been eaten right through by intercrystalline corrosion.

In another view of the same job (Fig. 2) it will be noted that the plain 18/8 steel suffers from general attack as well as intercrystalline corrosion, the 18/8 steel containing 3 per cent molybdenum being unattacked. The weld metal of similar analysis was also unaffected.

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(To be continued)



Fig. 1



Fig. 2

THE GERMAN FERROUS METAL INDUSTRY

Development of Hard Metals and Coatings

IT is not easy to determine with any certainty in which branches of the industry the Germans have made the most valuable contributions, but among the more interesting sections of ferrous metallurgy, which have become increasingly important in recent years, are hard metals, coatings, and general research. These have close affinities for the chemist.

A brief general note on the BIOS Overall Report No. 15: "The Ferrous Metal Industry in Germany During the Period 1939-1935" has already appeared in THE CHEMICAL AGE (61, 297).

Hard Metals

The section on hard metals is a short summary of the very thorough BIOS final report No. 1385 (37/6). During the war, a Hartmetallzentrale, established in 1934, controlled production, largely for tips for cutting tools and for dies. The principal members were Krupp, D.E.W. (Deutsche Edelstahlwerke) and Gebr. Böhler, with allocations respectively of 45, 7, and 3 tons—presumably per month.

Cemented tungsten carbide under the Krupp trade name Widia was first marketed in 1926. Every effort was made to conserve tungsten, and hydrogen for reduction purposes, by using carbon reduced metal. The reduction method developed by Gebr. Borchers gave a relatively pure product suitable for ammunition cores but less satisfactory in grain size.

Attempts to dispense with tungsten and use carbides of other metals met with little success, except with the V.814 grade containing 45 per cent TiC, 45 per cent VC and 10 per cent Ni, the last being found superior to Co as binder in this case.

The hard metals or carbides were regarded as the most important contribution of powder metallurgy to the war effort. The BIOS report fully details methods of metal powder manufacture, sintering and other processes.

The chief chemical plants concerned with the requisite raw materials—tungstic acid, tungsten powder, ammonium p-tungstate, TiO₂, CoO, Ni powder and sugar carbon—were Starck (Borchers), Wessendorf, Dicke & Co., Merck, I.G., and Riedel & De Haen. Visits to these works did not reveal any marked advance in known methods.

The following table gives the principal constituents of the Krupp tool tips. In

all, with other makes, there were 41 standard types:

Grade	Total C per cent	Free C per cent	W per cent	Co per cent	Ti per cent
S1 ...	7.57	0.21	73.33	5.48	12.76
S2 ...	7.30	0.21	73.06	7.64	11.13
S3 ...	6.17	0.16	82.55	6.63	3.77
G1 ...	5.90	0.15	87.75	5.68	—
G2 ...	5.65	0.18	83.22	10.46	—
G3 ...	5.50	0.32	79.32	14.46	—
H1 ...	5.83	0.12	87.82	5.66	—
H2 ...	5.83	0.16	85.14	6.80	—
F1 ...	8.10	0.06	66.86	5.48	18.30
F2 ...	12.80	0.05	32.40	5.25	46.60

Fe ranged from 0.25 to 0.71; Ni from 0.09 to 0.15; N from 0.03 to 1.1. In H2 were included V 0.5, Nb 0.2, Ta 0.77. Use of alumina in ceramic tool tips was not found very successful, despite considerable research.

Processes used for production of WC, TiC and mixed hard metal powders broadly resembled those in the U.K., although in Germany, as here, each firm had variations in detail. Mention should be made of the rotating tube reduction furnace of Krupp and others. The tube of 18/8 stainless steel revolved inside the heating element, with adjustable angle of tilt which, with rotation and automatic tapping hammer, facilitated the passage of material through furnace.

The vibration ball mills also were of interest. The vibrating portion was a carrier to hold four stainless steel ball mill containers. At full speed an eccentric shaft vibrated the carrier. The machine did its work in about one-fourth the time hitherto required.

Metal Powders

The large demand for metal powders provided opportunity to acquire considerable efficiency in handling these on a large scale. Pressing, sintering and other methods are comparable with those of the U.K. For long rectangular briquettes the die used by Metallwerke Plansee completely eliminated the risk of slip cracks or "wedges" and Krupp's use of a special die for pressing individual tips on hand presses differed from our more conventional pill press, and proved economic for short production runs.

While hot pressing was not used for tool tips, except in the case of those made without WC, it was employed largely for hard metal balls, large ring die pellets, including those of Widia Elmarid. The

latter is an unsaturated WC alloy containing 5.3 per cent total C in the carbide and 3 per cent Co as binder. Even with the non-tungsten hard metal, V.814, generally made by cold pressing/double sintering, Krupps preferred hot pressing and adopted it exclusively for ammunition cores, where it was said to be cheaper than the cold method.

As these contained only a small percentage of binder (3 per cent Ni), hot pressing would be better. The cores contained up to 92.3 per cent W, with 4.4 per cent total C, 0.03 per cent Ni, 0.30 per cent Fe, with some Ta and Nb to refine the grain. The plant used for hot pressing was interesting and ingenious, but showed no major improvement upon that of the U.K.

Krupps did not care for induction brazing, and torch brazing was too slow. They usually preferred a machine like a resistance welder made by Elektro-Apparatebau, of Lippstadt. Data were obtained on cutting angles and speeds, grinding of tips, and results of turning tests for various Widia grades.

Coatings (including cladding and bonding) form the subject of Section 8, while nitriding and related methods are included at the end of Section 6 on heat treatment.

The various methods of metallic coating and cladding, which are fairly well known, are described and have been already fully dealt with in earlier reports. Special attention is given to bi-metal work. Some notes are added on non-metallic coatings—lacquering and enamelling.

Valuable Research

In the important field of phosphating, German developments before the war had been very fully described in the technical Press. It must be recognised that here, at all events, they had done a lot of valuable research, especially for the canning and similar industries, and also in connection with phosphating as a lubricant in deep drawing or cold deformation processes.

Both in the interests of rust prevention and for lubricating purposes, rapid increase in production of phosphating chemicals was made during the war. Hot phosphating still predominated, but cold-working had made rapid strides, as also had the various methods of accelerating the practice of phosphating—down to a matter of two or three seconds. Yet the unaccelerated methods were still largely used, e.g., the Parker manganese method.

The usual stages in all cases are: preliminary treatment or cleaning, phosphat-

ing, after treatment (rinsing, drying, sealing). It has been common practice to use a water-oil emulsion of 10-25 per cent Shell oil No. 54 for sealing (Rhenania-Ossag, Hamburg). Metallgesellschaft A.G. (Parker and Bonder processes) was one of the largest producers of the necessary chemicals, followed by the I.G. Frankfurt-Griesheim (Atramentol processes).

The various chemicals include metal phosphates, phosphoric acid, and accelerators in the form of nitrites, nitrates and others, also those required in the preliminary cleaning, and final rinsing and sealing (generally chromic acid in some form). The I.G. Frankfurt-Griesheim accelerator was zinc chlorate. BIOS report No. 1298 gives full details of phosphating in Germany (7s.) and HEC documents provide information on Metallges. A.G. phosphating and general anti-rust processes, Nos. 3744 and 12200 and others.

Bonderising

The Volkswagen Works has installed a very elaborate plant for bonderising motor car bodies before painting, and this may be one of the largest and most modern installations in the world (BIOS Final Report 300).

Interviews with the director of the V.D.Eh. (German Iron and Steel Association) have been recorded. Here the work included ingot moulds, basic slag deoxidation of steel, use of Al and Fe-Si to economise Mn in S.M. steel, Ti as alloying element forming with sulphur a sulphide plastic at forging temperatures, steel made in electric furnaces, furnace atmospheres, and automatic multiple wire drawing machines.

At the Technische Hochschule, Aachen, including the Giesserei Institute (Foundry Institute), some interesting work comprised development of a hot blast cupola with blast preheated to 400-450°C., whereby coke charge could be reduced to 10 per cent of metal charge, yielding improved metal with reduction of S content. Rolling cast iron at 850-870°C. for use in the production of piston rings, improved mechanical properties, e.g., tensile strength was raised to 60-120 kg./mm². In using Al in place of Cr in heat-resistant cast iron, with C not more than 2.2 per cent, optimum Al content was 8 per cent, which may be compared with some pre-war results of the BCIRA in this country. Other work—tests on high speed steels and tool steels of superfinish on surfaces—is detailed in separate reports.

A large number of reports cover experimental research at the Deutsche Edel-

stahlwerke, Mulheim (iron powder production) and that of the D.E.W., at Krefeld, e.g., de-oxidation with Al and Mg, corrosion- and heat-resistant steels, welding alloy steels, properties at sub-normal temperatures, creep, effect of N as alloy element, etc.

High Temperature Alloys

At the Research Institute for Materials of the D.V.L., Sonthofen, important work on high temperature alloys for use in turbo superchargers and gas turbine jet units has been carried out. Any information in this difficult field is of special interest. Blading in temperatures was 620-750°, at which precipitation hardening had to be stable. Steels with Cr 11-14 and Mn 17-19, and with Cr 14-20 and Ni 9-32, did not give high enough creep strength and scale resistance. Higher alloys with only 10-40 per cent Fe were more promising. The following were chosen for the different temperature ranges:

Temp.	C	Mn	Si
1. Up to 700° ...	0.05-0.15	0.6-1	0.5-0.8
2. 650-750° ...	0.1	1-1.5	0.5-0.8
3. 750-800° ...	0.1	1-1.5	0.5-0.8

No. 1 contained also 1.3 Ta.

No. 2 contained also 1-1.3 Ti

No. 3 contained also 1.8-2.5 Ti.

A list of publications dealing with the study of materials at high temperatures is given. Other documents and volumes deal with machinability and tool life, conservation of important strategic alloys and materials thereof, with the introduction of several new steels, including lead-bearing steels. It was found that lead-bearing steels gained in machinability with use, even with Pb contents as low as 0.07 per cent; but Pb, as also Sb, Zn, Sn, and Cd, had little effect on other physical properties.

The Krupp Research Institute, Essen, undertook routine tests as well as research in several groups: heat-resisting and rustless steels, welding, general metallurgy, physics, chemistry, electro-chemistry, engineering, of which a general account is given in FD 1300/47 and 1309/1947, etc. In Volume 4 of this series (Krupp Reports 1941) are 17 articles on many subjects of great interest, e.g., hydrogen embrittlement, flake formation, coal carbonisation, Cr as de-oxidising agent, and electrolytic determination of iron carbide.

In this last article a method is described by which it is possible to isolate quantitatively practically unchanged carbide from all phases of carbon steel. In all heat

treatments it was shown that only FeC₃ is present.

Several interesting matters were discussed with Dr. Otto Reif, chief metallurgist at the Krupp research laboratory, Wülfrath: reduction of N content in basic Bessemer blows through additions of Na₂O; optimum combinations of Al, Mn, and Si for minimum non-metallic content when used as a de-oxidising addition to steel; conservation of Mn in additions to basic Bessemer blows; equilibria studies between bath and slag in basic Bessemer blows; solubility of N in Ni, Cr, and Mn alloyed steels. Properties of Izett and Alto steels are briefly noted.

On the subject of corrosion and related matters numerous reports have been issued, dealing, among other things, with the work undertaken by the I. G. Farbenindustrie on the metallurgy of hydrogenation plant, corrosive effect of liquid sodium on various metals, and corrosion of valve steels by lead and lead oxide, i.e., decom-

Cr	Ni	Mo	W	Co
15	35	5	5	25
13-15	30-34	5.5-6	4-4.5	25-30
15-18	10-15	7	3	30-40

position products of fuels containing Pb tetraethyl.

Special attention is directed to salt water corrosion in cooling Diesel engines. Here, smooth, even flow is of prime importance; where passages are constricted or eddy currents are formed, corrosion and erosion results, as would be expected. Zn protection plates, if not placed correctly, may cause erosion due to turbulence.

Low Carbon Steel

Reference is also made to the use of low carbon steel tubing with a chromium diffused surface for boiler air heater tubes and for Diesel engines. This "Inkromierung," yielding I.K.I. steel, is effected by heating at 1020°C. for 8 hrs. The composition of the layer, which is about 0.1 mm. thick, is given as Cr 22.58-22.68 per cent, S 0.07-0.16 per cent, P 0.033-0.093 per cent, and C 0.07-0.15 per cent. This protects against corrosion, in which also the Ti content of the steel seems to play a part.

The remainder of this section deals with routine testing and control work, including radiographic and supersonic methods.

The whole report, with its comprehensive index and reference lists, is an invaluable guide to the great mass of information which has been collected by British and American teams on German ferrous metallurgy.

LEAD PROSPECTS IN SOUTH AFRICA

Further Extensive Exploitation Possible

FUTURE development of lead in the Union of South Africa is likely to be materially influenced by two main factors. First, the possibility of profitably extracting lead ore, mostly secondary, which in many deposits is finely disseminated in manganiferous earth, and secondly, the necessity that all lead ore should be smelted in the country, if the mining is to be remunerative. The continuance of high world prices for lead per ton in the U.K., now £97, makes the prospect much more attractive.

These were the main conclusions of an extensive survey of the lead deposits of South Africa made during the war by a geological survey of the Department of Mines and now published in Geological Memoir No. 39, "Lead Deposits in the Union of South Africa and South-West Africa." This has been summarised in *The South African Mining and Engineering Journal* (60, part II, 273).

Occurrences of lead have formerly been exploited at Dwarfsfontein and in the Marico area. Rhenosterhoek 211 is the only occurrence in this belt where mining is being carried out actively, a concentrating plant and an experimental plant having been erected.

The dumps of waste and waste taken out since the mine first started are considered to contain about 50,000 tons with a percentage of between 10 and 15 of galena and other lead minerals. The evidence suggests that this deposit may become an important future source of lead.

Plant Erection

On Leeuwbosch 958, ten miles north of Thabazimbi, both bedded deposits and vertical veins occur, galena being the chief ore mineral in all the localities. All the prospects have been exploited by open-cast workings, the deepest point exposed in any of them being 40 ft. At one locality a vertical shaft 53 ft. deep has been sunk and a crushing and concentrating plant erected. During 1940-41, development was proceeding at four localities with promising indications.

An occurrence on the farm Langlaagte 1693 is worked for barite, and the erection of a plant for the recovery of the associated galena ore was stated to be under contemplation. Available evidence suggests that the occurrence is a valuable barite deposit, with lead ore as an important associate.

In the Hay district, galena is present in an old lead mine in a series of more or less parallel quartz veins in banded ironstones. Mine operations were abandoned after nearly 700 tons of galena had been removed. Despite poor showings of galena, it is considered that this mine might yet yield an appreciable quantity.

Apart from the relatively large quantities produced at Dwarfsfontein, the average annual production of all the occurrences in the Union amount to only a small proportion of the country's current requirements.

Undeveloped Occurrences

The distribution of lead ore in the Marico district is irregular and sporadic, while many of the old mines have fallen in, thus adding to the difficulty of estimating ore reserves.

Few of the known occurrences have, however, been worked out. In most cases, causes other than the exhaustion of the ore bodies were responsible for the cessation of mining activities, while many occurrences have not developed beyond the prospecting stage.

In its recent report the Department of Mines considers the most promising localities to be confined mainly to three districts: Marico, Springs and Hay (Griqualand West).

Memoir No. 39 listed four areas as offering possibilities of hidden concentrations of lead ore of economic importance, namely the Marico lead belt; the dolomite country north-west of Potgietersrust and in the vicinity of Chuniespoort; the ground occupied by the huge zenolith of the Transvaal System in the Bushveld igneous complex along the Crocodile River north-west of Brits; and the area in the vicinity of the farm Dwarfsfontein 21 on both sides of the boundary between the Springs and Pretoria districts.

The Union's ore reserves cannot be accurately assessed until much more development work has been undertaken, but a very rough estimate indicates that total reserves of the known deposits are in the vicinity of 50,000 tons of lead.

Numerous lead deposits are known in South-West Africa. Most important of these is the Tsumeb deposit in which a large number of minerals are present in the ores, the most abundant being galena, while the silver and cadmium contents of the ores are also commercially valuable.

RESISTANCE WELDING

Developments in the U.S.A.

A DETAILED description of the production of stainless steel railway coaches, which are welded throughout, almost entirely by the spot-welding process, was one of the prominent features of the lecture on "Resistance Welding Developments in the U.S.A." given at the recent meeting of the Birmingham branch of the Institute of Welding, by Dr. H. B. Taylor, director of research of the British Welding Research Association, and Mr. P. M. Teanby, of the association's liaison department.

The lecture cited the example of an American firm making the pipeline for conveying oil from Texas to New York. The pipeline was being made in 40-ft. lengths by flash welding, after having formed the flat plate to a circular section. The flash weld was 40 ft. long, and the area of the weld over 200 sq. in. The whole welding operation took a little longer than one minute, which was many times faster than the fastest alternative welding method.

Production Speeds

Not only was this particular use of welding of interest from the point of view of speed welding, but it was also an extremely good example where production speeds were kept exceptionally high by use of best handling and storage.

All the operations, from receiving the flat sheet to its passing out of the factory in the form of tube, were entirely automatic, and no hand operations were necessitated in welding, positioning or handling.

Another excellent example of the economic application of flash welding was given in the form of a welded air screw. Each blade of the air screw consisted of high tensile steel sheet formed to the correct shape and flash welded together. Each blade was then flash welded to the shanks. The fact that the finished propeller performed its job satisfactorily could be taken as an indication of the completely satisfactory nature of flash welding correctly applied.

The use of 3-phase welding machines was discussed, and it appeared that they were in much wider use in America than in this country. There were many advantages to be derived from the use of this type of machine, such as balanced loading on all three phases, higher power factors, and greatly increased electrode life when welding aluminium, etc. In spite of the high initial cost of such equipment, its use was often justified by those considerations.

U.S. LEAD TOTALS

Largely Increased Imports in 1948

DESPITE the high industrial demand in the U.S.A. for lead and the record market price reached by the metal in 1948, domestic mine output increased less than 2 per cent over 1947. Industrial disputes and stoppages are quoted by the U.S. Bureau of Mines as being largely responsible for the reduction of 25,000 tons in the 1948 total of available lead.

Imports of lead were 52 per cent greater in 1948 than in 1947 partly because of the desire for American dollars abroad and the suspension of lead import duties.

Primary refineries produced 411,646 short tons of refined lead during the year, a decline of 10 per cent from the 1947 output. Of the 406,690 tons of primary lead 83 per cent was produced from domestic supplies of ore and bullion. Antimonial lead from primary refineries increased by 17 per cent over the 1947 figure to 95,004 tons.

Total consumption in the U.S.A. of primary antimonial and secondary lead in 1948 was 1,115,995 tons. The physical inventory of lead stocks at primary smelters and refineries rose 113 per cent during the year and consumers' inventories increased 80 per cent. Manufacture of metal products accounted for 77 per cent of the total lead consumed and about 10 per cent was used for chemicals.

Labrador Iron Ore

PLANS for increasing the exploitation of the iron ore deposits in the Labrador area by the Labrador Mining and Exploration Company were announced last week.

Construction of a railway is to begin next autumn. Connecting with the Gulf of St. Lawrence, it will cover 360 miles.

The amount of ore mined is initially expected to be 10 million tons a year increasing to 20 million tons.

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INFLAMMABLE PLASTICS

Some Little Regarded Risks of Thermoplastics

THE danger that the fire risks associated with some plastics and base materials of plastics may be overlooked was brought prominently to light in the course of a paper presented by Mr. H. R. Fleck and subsequent questions and answers at the recent conference at Blackpool of the British Fire Services Association, of which an extended report appears in the December issue of the *Fire Protection and Accident Prevention Review*.

Mr. Fleck directed attention to the danger inherent in the circumstance that thermoplastic resin materials can undergo depolymerisation and yield an inflammable liquid when subjected to excessive heat. This could occur, in the case of some thermoplastics, as an effect of heat generated by the cutting tool when the material was being turned on a lathe.

Plastic materials were expensive and the scrap was valuable. Hazards arose in connection with the salvage. Very often smaller firms did not realise the dangers associated with thermoplastics, particularly as plastics as a whole do not show apparent hazards. Another point that had to be borne in mind when designing plastic objects was that they should not be traps for volatile solvents.

Paint and Lacquers

Dealing with the thermosetting powders. Mr. Fleck outlined the production of resins and their incorporation with such bases as wood waste. These powders had a tendency to burn if deliberately ignited before they had been thermoset.

Another hazard of plastics arose in connection with their use in paints; they were widely used as substitutes for white lead and linseed oil, and some paints were to-day made almost entirely from plastic materials.

The nitrocellulose lacquers, with their highly volatile solvents, were particularly hazardous from a fire point of view, though stringent Government regulations had partly reduced the dangers in manufacturing processes. There were hazards arising from the application of these lacquers, but they could be mitigated to some extent by the use of flame-proof equipment and so forth.

The chief dangers arose when nitrocellulose lacquers were used in the home, where it was difficult to apply legislation. It was here, suggested Mr. Fleck, that the

British Fire Services Association could be of great service by bringing to the notice of the public the dangers of plastic substances, such as toys, paints, cigarette boxes.

Mr. Fleck answered a number of questions by fire officers and representatives of industry. He acknowledged that regulations did not yet exist for notifying the carrying of stocks of plastics other than nitrocellulose, but he hoped the hazards of plastics would be classified and regulations made to cover the storage of each classification. As a chemist and a member of a local authority, he explained the action being taken by that authority with regard to the siting of plastics factories.

Questioned about the relative risks of synthetic spirits and ordinary petroleum materials, Mr. Fleck said he understood regulations covering the storage of inflammable spirits applied to all types having flash points below 73°F. Storage arrangements depended upon the volume being used, but it was good practice to build underground tanks for large quantities.

High Polymer Chemistry

A COURSE of post-graduate lectures of interest to industrial chemists, research workers, technical staff, and chemists and engineers associated with the plastics industry, will be given at Acton Technical College during the Spring Term, 1950.

The series will be given on Friday evenings at 7.30 p.m., beginning on January 8.

The Fischer-Tropsch and Related Processes will be the subject of the first two lectures by C. C. Hall, principal scientific officer, Fuel Research Station, DSIR (January 13 and 20). W. Davey (senior assistant, organic chemistry, Acton Technical College), will give two talks on The Theory of High Polymer Synthesis (January 27 and February 3).

The remaining eight lectures will be by W. H. Stevens, consulting chemist. Four will be on Polymers their Scientific and Industrial Classification, Plastics, Materials, Sources, Properties, Utilisation and Modern Industrial Processes (February 10, 17, 24 and March 3). The last four will cover Modern Methods of Testing and Analysis of Plastic Materials, Factory Procedure, Special Applications of Plastic Materials, and The Plastics Industry (March 10, 17, 24 and 31).

\$6.5 M. FOR GRANGEMOUTH

More British Equipment Available

THE apparent danger that the cost of equipping the Anglo-Iranian and Distillers Company petroleum chemicals plant at Grangemouth, Scotland, might represent a very heavy tax on hard currency reserves because of the need to buy some U.S. equipment at devaluation rates, is disposed of by the ECA's final approval in Washington on Monday of the advance of \$6.5 million as Marshall Aid. The sum originally mentioned was \$9 million, to cover American engineering fees and services and special equipment. Later, investigation showed that sufficient British equipment would be available to reduce dependence on American sources by the equivalent of \$2.5 million.

The Marshall Aid funds, says a message from Washington, will be supplied to the U.K. Government to buy the American equipment, etc., and the companies sponsoring the scheme will pay the full price of the machinery in sterling.

DDT for Packaging

A NEW departure in the field of packaging materials, which employs DDT as a pest repellent, has been notified by the DSIR's Pest Infestation Laboratory. This is in the form of cellulose wadding, in layers, impregnated with DDT.

On reaching the first lamination, claims the DSIR, the insects attacking a package find a maze of folds and tunnels which they invariably follow, instead of eating their way straight through. In their passage through these labyrinths the insects pick up sufficient poison to kill them.

In the many laboratory tests made not one insect has penetrated this material. Further tests are to be conducted by PATRA and use of the material on a trial commercial scale is planned in the near future.

Lactic and Rennet Casein

Lactic casein and rennet casein will revert to private trade on January 2, 1950. Imports will be regulated by individual licences, applications for which, to cover shipments during the first quarter of 1950 or for a longer period, may be submitted now to the Board of Trade R.M.&C., I.C. House, Millbank, London, S.W.1. The Board says that import licences for lactic casein will be granted subject to purchase also of Board of Trade stocks.

MORE FATAL ACCIDENTS

Few in Chemical Plants

MORE fatal industrial accidents and deaths from industrial diseases occurred in October than in the previous month, according to figures reported in the current issue of the *Ministry of Labour Gazette*.

Deaths from accidents in the course of employment in the United Kingdom in October were 114, compared with 108 in September and 156 (revised figure) in October 1948. Only four were reported in chemicals, oils, soaps, etc.; metal conversion accounted for five and other metal trades two.

Cases reported under the Factories Act, 1937, or the Lead Paint (Protection Against Poisoning) Act, 1926, in the U.K. in October showed one death in the pitch industry due to epitheliomatus ulceration (skin cancer). Total cases reported under the two acts numbered 41, as follows: Lead poisoning, four; other poisoning, four; anthrax, one; epitheliomatus ulceration, 19 (pitch, 11; tar, six; oil, two); chrome ulceration, 13; (manufacture of bichromates, three; chromium plating, five; other industries, five).

Industrial Health

SPEAKING on "Recent Advances in Industrial Health" to the Huddersfield Management Society, Dr. Robert Murray, H.M. Medical Inspector of Factories, instanced lead poisoning of which, in 1901, there were 1058 cases and 38 deaths; in 1947 there were only 58 cases and no deaths. Progress was due to the co-operation of doctors, research workers, management and labour. Benzene poisoning was being eliminated by the use of substitutes, and mule spinners' cancer might also be eliminated.

There were four principles used in the fight against industrial diseases: Substitution of harmless materials; mechanical handling; elimination of dust; and personal protection.

Vitamins and Analgesics

A NEW series of lectures on "Recent Developments in the Chemistry of Vitamins and Analgesics," by J. Elks and B. A. Hems, will be given in the second term at the department of chemistry of the Sir John Cass Technical Institute, London. The course starts on January 13, 1950.



The Chemist's Bookshelf

AN ADVANCED TREATISE ON PHYSICAL CHEMISTRY. Volume 1. Fundamental Principles and Properties of Gases. J. R. Partington. 1949. Longmans, Green & Co., London, New York and Toronto. Pp. xlii + 943. 80s.

This is the first volume of a highly detailed treatise intended to cover the whole realm of physical chemistry. Although designed to serve the graduate and research worker, it assumes, however, that the reader may require elementary expositions of fundamentals in every subject dealt with. Thus, for example, no knowledge of elementary calculus or even of trigonometry is presumed, and the mathematical novice is led by easy stages to the manipulation of partial differential equations and the mathematics of wave mechanics and statistical thermodynamics.

The preface, which is in part the author's apology for a work of the Teutonic type, is interesting and stimulating. The main divisions of this volume are concerned with Mathematical Introduction, Thermodynamics, Kinetic Theory of Gases, Statistical Mechanics and Quantum Theory, Wave Mechanics, Temperature, and Properties of Gases. The last comprises nearly half the text; the properties considered, p - v - T relations, specific heats, viscosities, etc., are entirely physical. Much space is given throughout to historical development; advanced mathematical and physical theory is closely linked with experimental technique; and numerous collections of numerical data, e.g., lists of standard free and available energies (pp. 226-228), critical data (pp. 641-646), melting and boiling points of inorganic and organic compounds (pp. 434-442), appear. There are 18,145 separate references, and papers up to the end of 1948 are included.

The section on thermodynamics contains much of the author's "Chemical Thermodynamics" but omits most of the applications. Some are found later in the present volume, and others, e.g., in electro-chemistry, will presumably be considered in subsequent volumes. All the sections contain much mathematical

theory, but abstruse mathematics is consistently avoided. Thus, mechanics is treated exclusively by the Schrödinger method.

The experimental side is always well to the fore but is perhaps most prominent in the section on temperature. This contains an immense amount of practical information on thermo-regulators, thermometers and thermo-couples, measurement of high and low temperatures, radiant heat, optical pyrometry, and liquefaction of gases.

There is unfortunately no name index, and the nine-page subject index must be considered inadequate. Examples of omissions are: laboratory cements (many are described on p. 588), nomography (lost in the text under the heading "The General Gas Law" p. 608), and mercury (data on vapour pressure p. 500, specific heats p. 826, relation between velocity of mercury in a capillary and pressure p. 881, use of syrupy metaphosphoric acid to keep the surface clean p. 562, etc.). Many additional references could be used with advantage.

There are very few errors and those detected are not serious, e.g., the rendering of Jones as "James" (p. 269), etc.

In view of the practical importance of the theory of probability and the treatment of experimental data the omission of these subjects from the mathematical introduction is surprising. It is noted, however, that the author ignores modern practice in his statement (p. 4 and also p. 9) that when there are several variables one must be varied at a time, the others being kept constant.

The printing, lay-out and general production deserve high praise. The price, which may not be excessive considering the high quality of the work, will undoubtedly put it beyond the means of many a would-be purchaser. When completed, the treatise will become the standard work on advanced physical chemistry if the remaining volumes achieve the comprehensiveness, attention both to experimental detail and theory, and clarity of the present one.

LETTER TO THE EDITOR

"Neglected Chemical Sources"

SIR,—The standard of articles in the British technical Press is usually high, and if the impression conveyed of the manufacturing resources of the British chemical industry is sometimes not very complete, this is doubtless because such information is difficult to acquire.

However, in an article on page 623 of your issue of November 5, which has only just come to my notice, Dr. J. F. Straatman is reported as making certain statements which are rather misleading and which do justice neither to our country's achievements nor to the enterprise of those whose task in industry is to keep in the forefront of technological progress and to make the fullest and most economical use of our natural resources.

Thus, Dr. Straatman would have us believe that the plastics industry has been handicapped by the reluctance of British manufacturers to produce synthetic phenol. The facts are that synthetic phenol has been produced for many years in this country in quantities which, together with natural phenol, have been sufficient to meet the demands of the plastics industry. It was only because of the boom conditions in the plastics industry and the Government constraints on the building of new plant that phenol had to be imported from America as a temporary measure a year or so ago. Additional synthetic phenol capacity was installed as rapidly as possible and ample supplies of phenol will be available when this is ready.

Dr. Straatman's remarks about the utilisation of home-grown cellulose would lead one to believe that this country had failed through mere inaction to make use of a raw material which is ready to hand, and that we preferred to import supplies from foreign sources. He completely disregards the careful assessment which must be made of both technical and economic factors before a major change from one raw material to another is effected. The results of such an assessment frequently reveal that the real merits of a superficially attractive scheme do not warrant a change to an entirely new raw material, or that the change must be brought about gradually and by introducing it in the most favourable localities first.

Again, Dr. Straatman implies that other countries have shown interest in the manu-

facture of sulphuric acid from anhydrite while this country lags behind in making use of this home-produced raw material.

We are aware that Germany has long made use of anhydrite for the manufacture of sulphuric acid, but we would point out—which Dr. Straatman has failed to do—that Imperial Chemical Industries, Ltd., has made sulphuric acid from anhydrite since the early 1930's. Production has been substantially increased since then and we can assure Dr. Straatman that extension of this method of manufacture is constantly in mind; when it is desirable and possible to do so, new plant will be built. Anhydrite has also been used directly in the manufacture of sulphate of ammonia to replace sulphuric acid and thus save imports of the necessary sulphur raw materials.

One of the most serious difficulties which this country has had to face as a result of its efforts in the war is the impossibility of constructing all at once the many new plants which we, as well as Dr. Straatman, would like to see, and the construction of many plants required by the chemical industry has been delayed on this account.

Finally, from the end of Dr. Straatman's talk it would be inferred that the chemical industry has given no thought to reducing its dependence on dollar imports of raw materials. Anyone with first-hand experience of the obstacles and difficulties in the way of importing dollar raw materials will know that, quite apart from price or policy considerations, manufacturers will make almost any effort to find some other source of supply.—Yours, etc.,

J. DAVIDSON PRATT,
Director.

The Association of British
Chemical Manufacturers,
166 Piccadilly, London, W.1.
November 28, 1949.

BAC Concert

The British Association of Chemists is to hold a smoking concert at 7 p.m. on Wednesday, December 14, at the Falstaff Restaurant, Eastcheap, London, E.C.3 (Monument station). Tickets are available from Mr. W. O. Petzold, programme secretary, London section, "Ilfra Tors," Selsdon Vale, Croydon, Surrey, at 10s. each, including buffet.

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Ceylon's Coconut Oil

Fresh U.K. Contract in New Year

From OUR SPECIAL CORRESPONDENT

A U.K. delegation, consisting of Mr. A. L. G. Fisher and Mr. G. Wigglesworth, of the Oils and Fats Division of the Ministry of Food, is at present in Colombo to negotiate a fresh agreement for the supply of copra and coconut oil from Ceylon. Under the present agreement, which expires at the end of the year, Ceylon had undertaken to supply 48,000 tons in terms of oil, 8000 tons of which is for Pakistan and the rest for the U.K.

The contract price is £55 per ton of copra f.o.b. Ceylon. The price in the open market, however, has risen considerably above the price agreed to in the existing contract, on account of the general shortage of oils and fats in the sterling area. Local coconut interests have, therefore, been urging the Ceylon Government to press for at least a 5-year agreement when the contract with Britain is revised.

The recently-appointed Ceylon Coconut Commission, in its report, has urged the necessity for guaranteeing to producers a satisfactory price over a period of years. Ceylon will, therefore, insist on an increased price for copra and coconut oil. Meanwhile, fresh coconuts have gone up in price and the market recently created a record for fresh nuts of Rs.435 per thousand. This is the highest price ever reached, and trade circles believe that this figure will be exceeded before the end of the year as the demand continues to increase.

Pakistan's decision not to devalue her currency has meant a cheapening of the price of Ceylon copra in terms of that currency. This may result in Pakistan acceding to a price higher than the present contract rate.

Improved Extraction

Arrangements are being made by the Ceylon Government to establish a hydrogenated coconut oil factory in the near future. By this new method it is expected to extract up to 99 per cent of oil from the copra milled in Ceylon. Machinery now used by private millers can rarely produce more than 90 per cent of oil, while there are many concerns utilising outmoded means of milling whose average yield is about 85 per cent. A sum of Rs.1 m. has been provided for the establishment of the factory.

The Ceylon Government Tender Board will place an order for Rs.6 million worth of machinery for the plant with a British firm which supplied the lowest quotation.

The Crown Agents have been asked to inquire into the capacity of the firm concerned, as two similar undertakings by the firm in India were said not to have been completed yet.

The Ministry is also making strenuous efforts to develop the scheme to manufacture oil from rubber seeds. Mr. L. H. Manderstam, chemical consultant to the Department of Industries, has said that on technical grounds there was no reason why rubber seed oil should not be made in Ceylon and even exported at a later stage.

Availability

Doubt has been expressed, however, regarding the availability of rubber seed to meet the capacity of 50 tons a day. If sufficient quantities are available it is likely that selective extraction, whereby the fraction of rubber seed oil containing high drying qualities can be extracted, will be undertaken locally.

Ceylon may enter into a separate agreement for the supply of copra and coconut oil to Pakistan next year. At present the contract with the United Kingdom covers supplies of these commodities to Pakistan too, and at last year's copra talks the United Kingdom representatives conducted negotiations on behalf of both countries.

Ceylon Proposes Caffeine Industry

CEYLON'S Department of Industries is to undertake the manufacture of caffeine out of tea. For this it is proposed to use only tea sweepings and tea refuse, which is available in large quantities in the island at present.

It is estimated that about 30,000 tons of tea are produced in Ceylon annually, of which about 1 per cent is thrown away as sweepings and refuse. About 30 million lb. of it are totally discarded.

Chemical analysis carried out by the department has shown that this tea contains about 2 per cent caffeine, at which rate it would be possible to manufacture about 60,000 lb. of caffeine a year. Caffeine is also contained in coffee beans, kola-nuts and in cocoa beans.

PERSONAL

DR. E. LESTER SMITH, of Glaxo Laboratories, Ltd., who isolated crystalline vitamin B₁₂ simultaneously with American workers in Merck Laboratories, left London Airport on November 27 to take part in the discussion in the U.S.A. by the World Health Organisation, of standardisation and other problems resulting from the recent isolation and purification of vitamin B₁₂ and its identification with the anti-pernicious anaemia factor. The discussions will take place in various American laboratories and are expected to continue for about four weeks.

MR. GEORGE MUNRO ASHWELL, president of the Institute of Packaging and chief packaging adviser of I.C.I., Ltd., leads the specialist team which sailed for the U.S.A. on December 2 to examine American methods of packaging and presentation. Other members of the team include: MR. J. H. SINGER, nominated by the ABCM, MR. W. A. G. PUGH, nominated by the British Plastics Federation, MR. R. A. LODGE, by the Toilet Preparation and Perfumery Manufacturers' Federation, and MR. F. G. WEST-ORAM, by the Glass Manufacturers' Federation. PATRA will be represented by its director of research, DR. G. L. RIDDELL.

DR. ERNEST MARSDEN will deliver the fourth Rutherford Lecture of the Physical Society at the Science Museum, London, at 5 p.m. on Wednesday, December 14. The doctor, who was formerly professor of physics at Victoria University, New Zealand, and more recently secretary of the New Zealand Department of Scientific and Industrial Research, has collected much information of the early family and student life of Lord Rutherford, with whom he was associated in experiments leading to the conception of the nuclear theory of atomic constitution.

MR. N. HOWELL has been appointed general manager of The Tudor Accumulator Co., Ltd., following the recent retirement of MR. P. CATTERMULL. Mr. Howell's first post after qualifying as a works chemist at the Manchester College of Technology, of which he is an associate, was on the technical and laboratory staff of the associated undertaking, the Chloride Electrical Storage Company, where he gained a wide experience in the whole field of battery manufacture.

"One who moves with an ease and an equanimity in the higher atmospheres far beyond the understanding of ordinary men" was the description applied by the Public Orator to SIR EDWARD APPLETON on whom was conferred the honorary degree of Doctor of Laws at London University on the occasion of the 113th anniversary of its foundation last week.

For their research and scholarship in several fields of study, the council of Sheffield University announces that the title of reader shall be conferred on DR. T. S. STEVENS, senior lecturer in organic chemistry, and DR. A. S. C. LAWRENCE, senior lecturer in physical chemistry, shall be reader in colloid chemistry.

PROF. DAVID CAMPBELL, Regius Professor of Materia Medica and Therapeutics at Aberdeen University since 1930, has been elected president of the General Medical Council in place of Sir Herbert L. Eason, who died in November 2. Prof. Campbell has been chairman of the Pharmacopoeial Committee, GMC, since 1937.

MR. D. W. POUNDER, who has gone out to Malaya as assistant director of research in the Dunlop Rubber Company's rubber plantations there, was a co-patentee in one of the basic patents taken out for the Dunlopillo process, and played a leading part in its development to the commercial scale.

Evans Medical Supplies, Ltd., has appointed MR. G. HUGHES as medical representative in Tyneside, North and South Durham and North and East Yorkshire.

The appointment of Miss H. H. EDWARDS, Director of Nursing Services, King Edward's Hospital Fund for London, and Miss E. M. GOSLING, of Unilever, Ltd., to be members of the Committee on Industrial Health Services, is announced by the Prime Minister.

Obituary

LADY MOND, whose death occurred last week at Belle-isle-en-Terre, Brittany, her birthplace, was the widow of Sir Robert Mond, eldest son of the scientist, Dr. Ludwig Mond. Lady Mond was 88.

MR. ELIAS GOLDBERG, whose death in Tel-Aviv, on November 26, is announced, was managing director of Evans Medical Supplies (Near East), Ltd.

HOME

Powder Metal Works Extension

Wolstenholme Bronze Powders, Ltd., proposes the building of extensions to Springfield Works, Bolton.

Vitaminised Preparations—Purchase Tax

The Commissioners of Customs and Excise announce that in future vitamin preparations containing added drugs or medicaments, in particular preparations of vitamins combined with mineral salts, will be regarded as medicines within Group 33 of the Purchase Tax Schedule, irrespective of the amount of the additions.

Ground Sulphur Price Increases

Under Statutory Instruction 1949 No. 2195, effective on December 1, the maximum prices of ground sulphur are increased by 33s. per ton. This is due to the change in the sterling-dollar exchange rate. The previous official prices for graded sulphur ranged from £15 ls. (120 mesh, BSI) to £17 3s. 6d. (200 mesh, in small consignments).

Import Licensing Relaxations

The Board of Trade has announced that as from Nov. 22 individual licences were no longer required for the importation of glycol esters except where they are consigned from or originate in hard currency areas (as mentioned in B. of T. Press Notice, ref: 29). Individual import licences would be required for glycol ether esters.

Naphthenic Acid Prices Rise

Shell Chemicals, Ltd., states that devaluation of the pound has made it necessary to increase prices for two grades of naphthenic acid. From December 1, naphthenic acid 20 (min. 200 acid value) will cost £1 10s. per ton more and the price of naphthenic acid 9 (min. 230 acid value) will go up by £4 per ton. The price of naphthenic acid (min. 170 acid value) is unchanged.

U.S.A. Interest in Scottish Development

Eight big American organisations in the precision engineering, chemical, and electrical field are interested in creating Scottish factories, according to Sir Steven Bilsland, speaking in New York. Sir Steven is leading a Scottish Council (Development and Industry) delegation to the U.S.A. and Canada to interest specialist firms in establishing factories in the Scottish industrial estate areas. The visit is stated to have been completely successful.

Titanium Pigments

National Titanium Pigments, Ltd., is building a large new factory at Kingsway, Luton, Beds.

End of Paint Materials Directorate

The Directorate of Paint Materials will end on December 31, states the Board of Trade. Its functions, including the allocation of linseed oil, will be carried by the Raw Materials Department (RM2C) Board of Trade, Millbank, S.W.1. The director, Mr. G. Gillies Shuck, will return to private industry.

Fifty Years' Research

Congratulations from the King and from ten foreign countries were received at a reception last week marking the 50th anniversary of the Liverpool School of Tropical Medicine, one of the oldest schools of its kind, which has made many discoveries in the fight against tropical disease, particularly malaria.

Oil Refineries Machinery

Electrical machinery and switchgear for British oil refinery expansion will be subject to the requirements of the Factories Acts and of the special regulations made under those Acts, the Minister of Labour stated in the House of Commons this week. These requirements will be imposed irrespective of where the machinery comes from.

RIC Established in Dundee

The essential and far-seeing services of chemists of various branches to industry, public health and civilised amenities were called to mind in the inaugural address given last week to the newly formed Dundee and District section of the Royal Institute of Chemistry. The speaker was Dr. H. J. T. Ellingham, secretary of the institute. Mr. Andrew Dargie, city analyst of Dundee, section chairman, presided.

Coal Production

The aggregate output of deep-mined and opencast coal in Britain so far this year is 194,202,600 tons, compared with 188,692,100 tons in the same period last year. Comparative weekly production figures are:—Last week: 4,472,700 tons (deep-mined 4,275,600 tons, opencast 197,100 tons); previous week: 4,519,100 tons (deep-mined 4,289,700 tons, opencast 229,400 tons); week ending November 27, 1948: 4,267,500 tons (deep-mined 4,088,400 tons, opencast 179,100 tons).

Next Week's Events

MONDAY, DECEMBER 5

Society of Chemical Industry

London: London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, 6.30 p.m. (With R.I.C.). A. M. Robertson: "Fibreglass."

Oil and Colour Chemists' Association

Hull: Royal Station Hotel, 6.30 p.m. N. H. E. Ahlers: "Absorption Spectrophotometry."

TUESDAY, DECEMBER 6

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 3.45 p.m. (Food Group, joint meeting with the Society of Public Analysts and other Analytical Chemists). "Properties of Pectin and its use in the Food Industry."

Chemical Engineering Group (S.C.I.)

London: Burlington House, W.1, 5.30 p.m. Dr. W. H. J. Vernon and Dr. K. R. Butlin: "Underground Corrosion of Ferrous Metals: Causes and Prevention."

The Institute of Physics

Glasgow: University, 7 p.m. (Scottish Branch). Prof. N. F. Mott (University of Bristol): "The Physical Explanation of the Strength of Metals."

Hull Chemical and Engineering Society

Hull: S. J. Porter: "Zirconia"; P. A. Andrews: "Industrial Dust Recovery."

Institute of Metals

Swansea: University College, Singleton Park, 6.30 p.m. (South Wales Local Section). Asst. Prof. R. Higgins: "Refractories with Special Reference to Slag Corrosion."

Electrodepositors' Technical Society

Birmingham: James Watt Institute, Great Charles Street, 6.30 p.m. Dr. A. T. Steer: "Hard Chromium Deposits as a Means of Resisting Wear."

WEDNESDAY, DECEMBER 7

Institute of Welding

Manchester: Reynolds Hall, College of Technology, 7.0 p.m. C. C. Henderson: "Stud Welding."

Manchester Metallurgical Society

Manchester: Engineers' Club, Albert Square, 6.30 p.m. N. Davidson: "Design of Wire Drawing and other Cold Working Machines."

THURSDAY, DECEMBER 8

Incorporated Plant Engineers

Newcastle-on-Tyne: Turks Head Hotel,

7.15 p.m. K. Marwood: "The Use of Electronics in Industry."

Institute of Physics

London: 47 Belgrave Square, S.W.1, 5.30 p.m. Dr. F. P. Bowden (University of Cambridge): "Some Physical and Chemical Effects of Friction."

Institute of Metals

London: Waldorf Hotel, Aldwych, W.C.2 (with Institute of British Foundrymen). P. D. Liddiard and P. G. Forrester: "Casting Copper-Lead Bearings."

FRIDAY, DECEMBER 9

Society of Chemical Industry

London: King's College, Strand, W.C.2, 7.0 p.m. (Fire Chemicals Group). Dr. B. A. Hems (Glaxo Laboratories, Ltd.): "A Synthesis of L-Thyroxine."

Oil and Colour Chemists' Association

Manchester: Engineers' Club, Albert Square, 2.0 p.m. "Paint Laboratory Equipment."

Institute of Physics

Manchester: University, 7.0 p.m. Lecture by Prof. P. M. S. Blackett.

The Royal Institution

London: 21 Albemarle Street, W.1. Prof. M. G. Evans: "Oxidation-Reduction Reactions."

Manchester Statistical Society

Manchester: Albert Hall, Peter Street, 6.45 p.m. G. E. P. Box: "The Design and Analysis of a Chemical Experiment."

Society of Glass Technology

Manchester: E. Preston: "Mistakes in Glass Manufacture."

Association of Special Libraries and Information Bureaux

Liverpool: Hornby Library, William Brown Street, 2.30 p.m. S. C. Jennings (Dunlop Rubber Co., Ltd.): "The Organisation of Works Visits"; E. N. Simons (Edgar Allen & Co., Ltd.): "The Preparation of Technical Literature."

SATURDAY, DECEMBER 10

Institution of Chemical Engineers

Manchester: College of Technology, 3.0 p.m. (North-Western Branch). J. S. Forsyth and N. L. Franklin: "The Composition of Fractionating Column Products Under Various Reflux Conditions."

Society of Leather Trades' Chemists

Manchester: Engineers' Club, Albert Square, 2.0 p.m. G. H. W. Humphreys: "Some Sole Leather Problems"; G. Forsyth: "The Rapid Determination of Moisture in Leather."

OVERSEAS

U.S. Sulphur Tonnage

Production of native sulphur in the U.S. during August was 397,024 long tons. Apparent sales were calculated at 383,117 tons, and producers' stocks increased slightly to a total of 3,156,752 tons.

Uranium Ore in Utah

A uranium discovery about 220 miles south of Salt Lake City, Utah, has been described by the general manager of the Vanadium Corporation of America as being the best occurrence yet located in the U.S.A. and the only one to justify the erection of processing plant on the site.

U.S. Powder Metallurgy Exhibition

The annual U.S. metal powder exhibition, sponsored by the Metal Powder Association, will be held on April 25 and 26, 1950, at the Book-Cadillac Hotel in Detroit. It will present some of the latest products and developments in metal powders, fabrications and equipment.

Surinam's Bauxite

The production of bauxite in Surinam in 1948 was 2,120,000 long tons, 20 per cent higher than the figure for 1947. This was the first time that Surinam had produced more bauxite than neighbouring British Guiana. Exports were confined almost entirely to the U.S.A.

India's Manganese Exports

Greater exports of Indian manganese ore are likely, now that problems of transport are being overcome. This was revealed at a conference held in New Delhi last month between the chief controller of exports and representatives of both the Indian Government and mining interests. Exports from India in the first 10 months of this year reached 500,000 tons, compared with a total of 330,000 tons for last year.

Swiss Chemical Industry

The future of the country's chemical industry was discussed at a recent meeting of the Association of Chemical Industrialists held in Basle, Switzerland. Exports have been seriously affected by the widespread devaluation of currency since September, and trade with Eastern Europe has also declined. A statement issued after the meeting says that no improvement is likely in the near future, that the industry must adapt itself to changed conditions, and fears that some decrease in employment is unavoidable.

Ceylon's Fertiliser Project

The output of the fertiliser plant which it is proposed to erect in Ceylon is expected to amount to some 50,000 tons of ammonium sulphate a year. That would be sufficient to supply the whole of the island's requirements.

Metric System for India?

Adoption of the metric system of weights and measures throughout the country has been proposed by a special committee of the Indian Standards Institution. The gradual adoption, over 10-15 years, of this and of decimal currency was recommended.

Burma Government Buys Oil Shares

The Burma Government hopes to buy 33½ per cent of the shares of the British owned Burmah Oil Company, said Thakin Nu, Prime Minister of Burma, at a recent meeting of oilfield workers. Talk of confiscating the oilfields without compensation was "sheer nonsense."

Netherlands Coal

Dutch coal output in August was 984,000 tons, more than twice the monthly average in 1945. Production in prewar years averaged one million tons a month. Lower labour productivity and a shortage of miners have prevented that level being attained. Holland still imports about 25 per cent of her coal requirements.

CIBA Representatives Arrested

During the recent wave of arrests in Czechoslovakia, the representatives of CIBA in Prague and Brno, respectively, Messrs. Hichter and Hostynek, are reported to have been taken into custody. It is believed that the arrests were the result of the ruling of the Czechoslovak Government that foreign companies must not be represented in the country by Czechoslovak citizens.

Rubber Research

A new rubber research centre is to be opened by the Dunlop Rubber Company on their Regent estate in Negri Sembilan, Malaya, some 25 miles from Malacca. A new two-storey building contains large, air-conditioned laboratories for fundamental and development research work on rubber. The new centre has living quarters for its director, Dr. F. J. Paton, Mr. D. W. Pounder, who has been appointed assistant director, and for two other research chemists.

Law and Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Receivership

PORTSLADE BY-PRODUCT CO., LTD., 20/22 West Street, Shoreham-by-Sea. (R., 3/12/49.) Mr. C. E. Wakeling, of Prestwood, Dyke Road Avenue, Brighton, was appointed receiver and manager on November 3, 1949, under powers contained in debenture dated November 29, 1948.

Company News

Wade Potteries, Ltd.

The statement of accounts of Wade Potteries, Ltd., to be presented to shareholders at Burslem on December 14, indicates there was a net trading profit of £43,295 in the year ended. A dividend of 25 per cent on the ordinary shares is recommended.

Attock Oil Company

Production in Pakistan by the Attock Oil Company was nearly 50 per cent higher in 1948 than in the preceding year, and trading profit increased from £30,900 to £132,900. For the first nine months of the current year there has been a further expansion of some 60 per cent, states Mr. T. T. McCreath, the company's chairman. It is hoped to pay a dividend next year, for the first time in five years.

Increases of Capital

The following increases in capital have been announced: **CLIFFORD & NEALON, LTD.,** from £500 to £1500; **GRANGERSOL, LTD.,** from £100 to £5000; **SILVERWOOD CHEMICALS, LTD.,** from £5000 to £20,176; **CIMEX, LTD.,** from £5000 to £20,000.

New Registrations

Liquid Coal Products, Ltd.

Private company. (475,223). Capital £100. Manufacturers of patent fuel and coke; carbonisers and distillers of coal, shale and other substances; gas motor spirit, oils, dyes, benzenes, naphtha, anthracenes, naphthalenes, etc. Sec.: J. Bravo, 71 Moorgate, E.C.2.

Petrosolvents (London), Ltd.

Private company. (475,330). Capital £100. Manufacturers, producers, refiners, distillers of soaps, candles, greases, tallows, petroleum products, etc. Subscriber: E. C. Drenon, 81 Kynance Gardens, Stanmore, Middlesex, research chemist.

ANTARCTIC WHALING

WHALING expeditions, employing 10 Norwegian factory ships, three British, two Japanese, one Dutch, one Russian and one South African, are bound for the Antarctic for the coming season. It is hoped that they will bring back some 30,000 whales.

Each factory ship is served by from 10 to 17 whale catchers, each with 12 to 17 men. Acting as auxiliaries will be 36 tanker transports and six refrigerated meat ships making, in all, a flotilla of some 300 ships, manned by 12,000 men. The vessels should remain in southern waters from December 22, 1949, until April 7, 1950, the provisional closing date for the season.

It is hoped that oil, meat and by-products from the catch will be worth at least £30 million, states Mr. S. G. Tregaskes, Assistant Commercial Secretary for Canada, in an article in *Foreign Trade* (6, 851). Each expedition aims to surpass the postwar record yield of 205,000 barrels of oil, established by the British factory ship *Southern Venturer*, in 1947. The largest yield ever was 240,000 barrels, achieved by a Norwegian factory ship in 1932.

Voluntary Limitation of Bleaching

TO reduce the surplus productive capacity of the textile bleaching industry a voluntary scheme has been adopted by the existing traders which would amount to complete rationalisation, if it is accepted by the Board of Trade. A new company, Bleaching Trade Reorganisation, Ltd., has been formed to acquire or dispose of real or personal property, and deal with it in such a way as to prevent or restrict under covenant its use in textile finishing. It is pointed out that even taking into account works still closed under the Government war-time concentration arrangements, present productive capacity still considerably exceeds the present and any probable future demand.

The Stock and Chemical Markets

STOCK markets have remained cautious and uncertain, reflecting the waiting attitude shown by investors. Little selling was in evidence but, on the other hand, buyers appear to be taking the attitude that caution is called for until the General Election has been held. The two factors dominating markets this week have been the further rally in British Funds and the £20 million loss foreshadowed for the British Transport Commission, necessitating the higher freight rates now proposed. The latter will have the effect of a general increase in production costs and will hit exporters as well as producers for the home market. Industrial shares have therefore not responded to the rally in British Funds.

Most movements in shares of chemical and kindred companies were small. Imperial Chemical eased to 42s., Monsanto Chemical kept at 50s., Fisons were 26s. 9d., Albright & Wilson 30s., and Brotherton 10s. shares 19s. 6d. Boake Roberts have changed hands around 25s. and Burt, Boulton & Haywood around 24s. 6d. Greff Chemicals Holdings 5s. shares were marked 9s. At the placing prices of 22s. for the preference shares of Willows Francis Pharmaceutical Products the yield is $5\frac{1}{2}$ per cent, while the 2s. 6d. ordinary shares at 3s. 4½d. will yield $7\frac{1}{2}$ per cent on the basis of the 12½ per cent dividend predicted if the directors' profit estimate is realised. Application has also been made for Stock Exchange dealings in the $5\frac{1}{2}$ per cent £1 preference shares of Howards & Sons, the Ilford chemical manufacturers. There is no intention at present of introducing the ordinary shares of this company to the Stock Exchange, but this may be planned for the future.

Borax Consolidated remained firm at 57s. 6d., British Glues 4s. ordinary were 17s. 3d., but plastics shares fell back, British Xylonite receding to 57s., after an earlier gain, while De La Rue were down to 21s. 3d., and Kleemann 8s. 3d. Lever & Unilever, however, strengthened to 42s. United Molasses were steady at 37s. 6d. on the company's latest deal. The 4s. units of the Distillers Co. firmed up to 17s. 1½d. Glaxo Laboratories at £21½ remained under the influence of the pending bonus.

Boots Drug have been firm at 48s. 6d., Beechams deferred 14s. and Sangers 22s. 4½d. Iron and steels lost part of recent gains, but later became firmer, Dorman Long being 31s. 3d., Colvilles

34s. 9d. and United Steel 27s. 9d. British Oxygen at 90s. 3d., British Aluminium at 41s. 6d. and General Refractories at 22s. were firm. Turner & Newall eased to 73s. 9d. and Dunlop Rubber to 60s. 6d.; Triplex Glass showed firmness at 17s. 3d. There were small irregular movements in oils.

Market Reports

ALTHOUGH the industrial chemical markets are without special feature an active trade is reported from most sections and inquiry for new business covers a fairly wide range of materials. In the soda products there is a certain amount of pressure for deliveries against contract commitments and a good demand continues for the potash chemicals. Further changes in the controlled price of pig lead have again altered red and white lead prices. The latest dry red lead basis price is £115 15s. per ton and for dry white lead £124 5s. per ton. Export trade continues to be good with little or no easing in the volume of inquiry. The coal tar products market continues to maintain a better appearance with tar acids moving well.

MANCHESTER.—Home-trade users of caustic soda and other alkali products are calling for steady deliveries and a satisfactory demand for a wide range of other heavy chemicals has been reported during the past week. The volume of new business on home-trade account seems generally to have been maintained at around the level of recent weeks. Shippers' inquiries have been fairly numerous and have covered a wide range of products for the usual outlets. Business in fertiliser materials is at the moment only moderate and no substantial improvement is looked for until after the turn of the year. A fair trade is being done in the by-products, more especially in the white spirits.

GLASGOW.—Shortage of supplies of xylol, both 2-5° and 3-5°, has become acute. The position has been gradually deteriorating for some time, with the gradual increase of demand for the material in Scotland. A shortage of sodium sulphate continues, although the position is showing signs of easing. The demand for carbon tetrachloride is steadily increasing. Trisodium phosphate has been in heavy demand and the delivery position is not too good at the moment. The export market is uneventful.

Patent Processes in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted will be obtainable, as soon as printing arrangements permit, from the Patents Office, Southampton Buildings, London, W.C.2, at 2s. each. Higher priced photostat copies are generally available.

Complete Specifications Accepted

Process for the extraction and purification of wax obtained from the flesh of sisal.—A.S.P. Chemical Co., Ltd., C. L. Walsh, B. A. Adams, and J. P. Cook. Jan. 15 1947. 630,270.

Process for the extraction and purification of wax obtained from plant leaves or flesh.—A.S.P. Chemical Co., Ltd., C. L. Walsh, B. A. Adams, and J. P. Cook. Jan. 15 1947. 630,271.

Catalytic conversion.—Texaco Development Corporation. March 7 1946. 630,155.

Synthesis of carboxylic acids.—E. I. Du Pont de Nemours & Co., W. F. Gresham, and R. E. Brooks. Feb. 19 1947. 630,279.

Metal-phenol-nitrogen compounds.—Bakelite Corporation. Feb. 27 1946. 630,158.

Catalysts.—I.C.I., Ltd., and P. W. Reynolds. Feb. 26 1947. 630,161.

Alkali and acid resistant polyamine-modified phenol-formaldehyde resins.—Bakelite Corporation. March 13 1946. 630,162.

Synthesis of penicillin.—Merck & Co., Inc. March 23 1946. 630,284.

Gaseous fuel mixtures.—S. H. White. March 13 1947. 630,221.

Heat treatment of alloyed or unalloyed cast iron.—Mond Nickel Co., Ltd. (International Nickel Co., Inc.). March 22 1947. 630,093.

Manufacture of peroxides.—Distillers Co., Ltd., G. P. Armstrong, R. H. Hall, D. C. Quin, and K. H. W. Turck. April 1 1947. 630,286.

Process of treating barium and strontium sulphates.—G. & W. H. Corson, Inc. April 30 1946. 630,034.

Manufacture of aminoguanidine compounds.—I.C.I. Ltd., and G. R. Campbell. May 21 1947. 630,296.

Process of sulphiding solids.—N.V. Internationale Hydrogeneeringsoctrooien Maatschappij (International Hydrogenation Patents Co.). July 9 1946. 630,042.

Production of ketene.—Soc. Rhodi-aceta. July 16 1946. 630,043.

Preparation of compounds of the cyclopent anodimethylpolyhydrophenanthrene series.—Merck & Co., Inc. July 14 1945. 630,103.

Gasification of solid carbonaceous materials.—K. Koller, and F. Esztergaly. Oct. 26 1942. 630,048.

Manufacture of azo dyestuffs.—J. R. Geigy A.G. Oct. 31 1946. 630,181.

Preparation of silica.—D. E. B. Green-smith, C. Shaw, and W. E. Langrish-Smith. Dec. 10 1947. 630,182.

Processes for the reduction of metallic oxides or metal oxide ores.—H. W. K. Jennings. (H. A. Brassert & Co.). Dec. 16, 1946. 630,122.

Device for mixing, kneading and feeding powders, more particularly thermoplastic and thermo-hardening powders, for the manufacture of shaped bars.—S.P.A. Lavorazione Materie Plastiche. Dec. 14 1940. 630,304.

Fluid-heating.—Babcock & Wilcox Co. July 4 1944. 630,549.

Polymerisation process.—Phillips Petroleum Co. Dec. 14 1948. 630,484.

Alkylation of phenols.—I.C.I., Ltd., and J. E. Fearey. May 17 1946. 630,487.

Method and apparatus for cooling a powder formed from a molten metal.—H. R. Forton. June 25 1945. 630,560.

Setting compositions.—Dunlop Rubber Co., Ltd., and M. Goldstaub. May 30 1946. 630,488.

Stabilising sulphur-containing organic compounds against oxidation and setting compositions produced from such stabilised compounds.—Dunlop Rubber Co., Ltd., and M. Goldstaub. May 30 1946. 630,489.

Manufacture of derivatives of amides.—Ciba, Ltd. July 16 1945. 630,492.

Manufacture of intermediates in the synthesis of adrenal cortical hormone.—Merck & Co., Inc. July 14 1945. 630,430, 630,431, 630,432.

Heaters for viscous liquids.—Babcock & Wilcox, Ltd. Feb. 2, 1940. 630,434.

Manufacture of azo dyestuffs.—Soc. Anon. de Matieres Colorantes et Produits Chimiques Francolor. Aug. 24 1945. 630,564.

Process of producing pig iron.—C. R. Holzworth. July 25 1940. 630,566.

Flotation equipment.—A. P. Thurston. (Owens-Corning Fibreglas Corporation). Sept. 24 1946. 630,317.

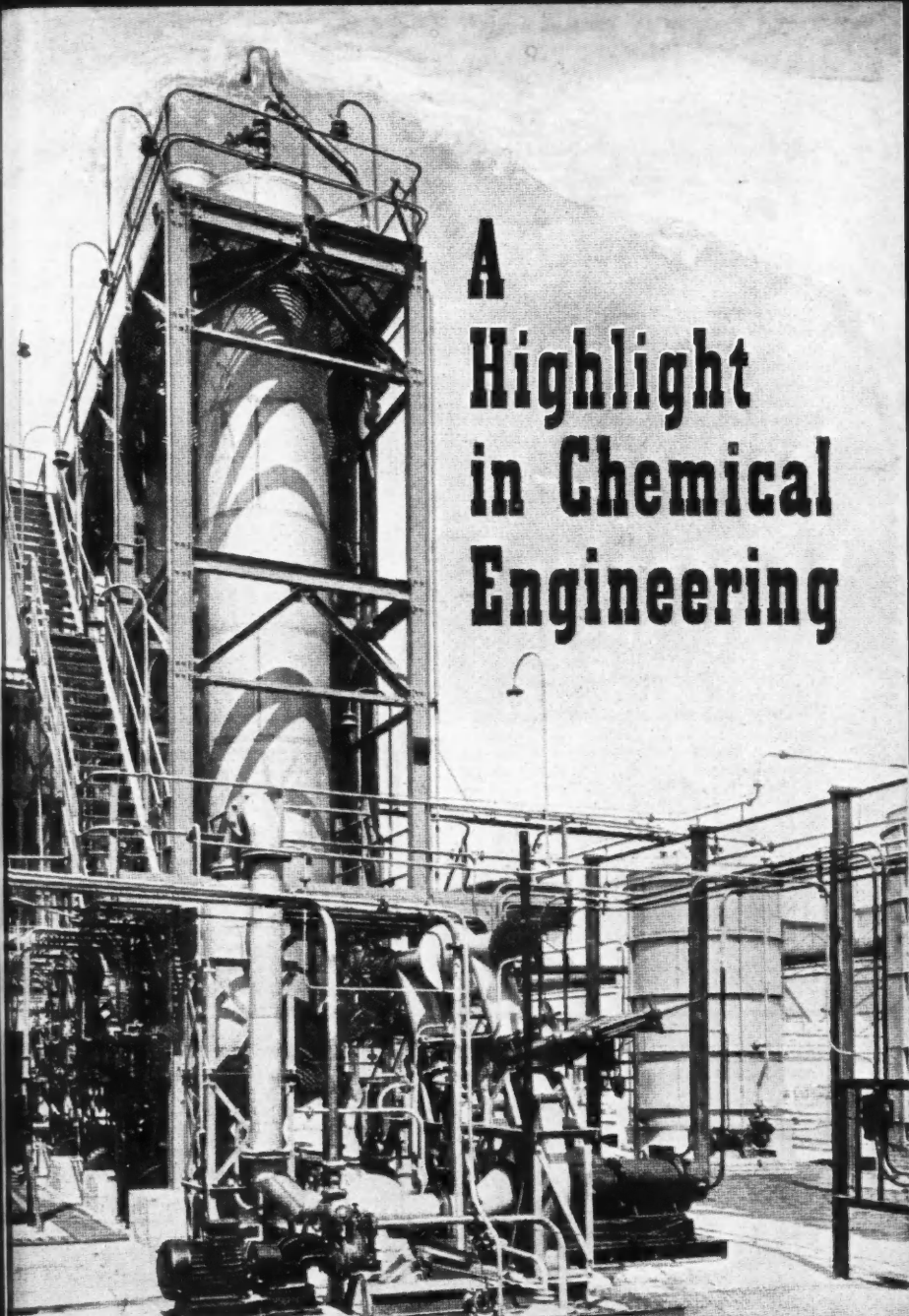
Compositions containing polymeric silicoes.—Westinghouse Electric International Co. Sept. 20 1944. 630,319.

Polysiloxane resins.—British Thomson-Houston Co. Nov. 21 1945. 630,445.

Glass composition.—British Thomson-Houston Co., Ltd., and J. E. Stanworth. Jan. 15 1947. 630,504.

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A Highlight in Chemical Engineering

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Production of polymerisable organic materials.—I.C.I., Ltd., and R. Hammond. Dec. 30 1946. 630,370.

Apparatus for the purification of liquids.—W. Paterson. Jan. 31 1947. 630,505.

Manufacture of vat dyestuffs of the anthraquinone series.—Ciba, Ltd. Feb. 12 1946. 630,375.

Indicating instruments.—Liquidometer Corporation. June 28 1946. 630,448.

Amino acid products and method of producing same.—Sterling Drug, Inc. May 4 1946. 630,376.

Conveying machines and apparatus.—Campbell & Isherwood, Ltd., and J. Meredith. April 3 1947. 630,512.

Cutting raw or crude india-rubber.—H. R. Williams. April 3 1947. 630,451.

Manufacture of polyazo-dyestuffs.—Ciba Ltd. April 16 1946. 630,452.

Antibiotics and method for obtaining the same.—Parke, Davis & Co. May 20 1946. 630,383.

Apparatus for continuously separating liquid from solids.—C. Verdoorn, and W. M. C. Visser. May 6 1946. 630,587.

Coating compositions.—E. I. Du Pont de Nemours & Co. May 6 1946. 630,334.

Production of cellulose esters.—British Celanese, Ltd. July 2 1946. 630,383.

Pack-annealing bed.—Birdsboro Steel Foundry & Machine Co. Sept. 2 1941. 630,521.

Shale distillation process.—Standard Oil Development Co. Aug. 14 1942. 630,453.

Process for the manufacture of acid dyestuffs of the anthraquinone series.—Sandoz, Ltd. July 5 1946. 630,523.

Process for the manufacture of dyestuffs and intermediates.—I.C.I., Ltd., and D. A. W. Fairweather. July 11 1947. 636,459.

Asphaltic bitumen compositions.—N.V. De Bataafsche Petroleum Maatschappij. July 19 1946. 630,590.

Preparation of salts of penicillin.—Glaxo Laboratories, Ltd., and W. K. Anslow. July 7 1947. 630,462.

Process for the coloration of paper.—I.C.I., Ltd., V. G. Morgan, and F. North. July 10 1947. 630,463.

Plasticised polymeric vinyl halide compositions.—B. F. Goodrich Co. March 9 1940. 630,338.

Process for the manufacture of acid dyestuffs of the anthraquinone series.—Sandoz, Ltd. July 26 1946. 630,592.

Dehydration by distillation.—Standard Oil Development Co. March 15 1947. 630,466.

Crystallisation of chemical compounds and apparatus for use therein.—Midland Tar Distillers, Ltd., R. Scott, and E. H. Joseelyne. Aug. 13 1947. 630,897.

Method of, and apparatus for, making oil gas.—Gas Machinery Co. March 20 1942. 630,398.

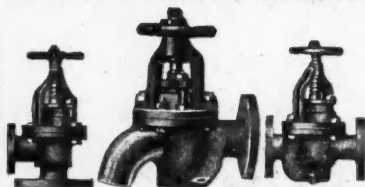
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SITUATIONS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50 inclusive, or a woman between the ages of 18 and 40 inclusive, unless he or she is exempted from the provisions of the Control of Engagement Order, or the vacancy is for employment exempted from the provisions of that order.

EASTERN GAS BOARD (Tottenham Division)

APPLICATIONS are invited from suitably qualified persons for the following technical appointments at the Tottenham Works (20 million cubic feet per diem) of the Division. Salaries in accordance with the A.P.T. Scales of the London Regional Joint Council for Gas Staffs.

(1) SHIFT SUPERINTENDENT

Candidates must have obtained the Higher Grade Certificate of the Institution of Gas Engineers in Gas Engineering (Manufacture) and have had considerable Gas Works operational experience.

Salary, £520 to £600 per annum (Grade A.P.T.8).

(2) RELIEF SHIFT SUPERINTENDENT

Preference will be given to candidates who are in possession of the Higher Grade Certificate of the Institution of Gas Engineers in Gas Engineering (Manufacture).

Salary, £440 to £520 per annum (Grade A.P.T.6).

(3) LABORATORY CHEMIST

The successful candidate will be required to take charge of the Chemical Laboratory at Tottenham Works. Candidates must hold a University Degree in Chemistry or an equivalent qualification and have had experience in the Gas, Fuel or Heavy Chemical Industries.

Salary, £520 to £600 per annum (Grade A.P.T.8).

Applications for the above appointments, stating age and giving full details of training, qualifications and experience, should reach the Personnel Officer, Woodall House, 658, Lordship Lane, Wood Green, N.22, not later than December 10th, 1949.

SITUATIONS VACANT

A Persian Gulf Oil Company urgently requires a CHEMIST for Topping Plant. Must possess degree in Chemistry or Chemical Engineering. Experience in testing petroleum and products or allied processes desirable. Age under 35. Salary starting £910 p.a., tax free. Free messing and accommodation. Kit allowance. Write, giving brief details, age, experience, etc., and quoting K.1010 to Box "P.Y." c/o J. W. Vickers & Co., Ltd., 7/8, Great Winchester Street, E.C.2.

APPLICATIONS are invited from QUALIFIED ENGINEERS, B.Sc. or A.M.I.Mech.E., for important Chemical Works, Manchester area.

Applicants should not be over 40 years of age, and have experience in Maintenance, Chemical Plant Erection and Design. Position offered is permanent and progressive. Only men of proved ability need apply. Address in the first instance, with particulars of qualifications, experience in detail, and salary expected. Box No. 2872, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

CHEMIST required for Birmingham Light Engineering Works. Qualifications: Honours Degree, sound experience Electro-Chemistry, Electro-plate and Paint Finishes. Ability to supervise junior staff and organise day-to-day work of chemical laboratory dealing with both works and development problems. State age, full details experience, qualifications and salary. Box No. 2878, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

MANUFACTURING Chemists in London require for research work a QUALIFIED CHEMIST with specialised knowledge of the soap and perfumery trade. Commencing salary £1,200 per annum, plus share of profits. Applications, giving complete details regarding age, qualifications, experience and previous positions held, should be sent to Box No. 2875, The Chemical Age, Fleet Street, London, E.C.4.

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THORIUM LIMITED invite applications from QUALIFIED CHEMISTS for vacancies at their Kars Earth Chemical factory at Ilford. Applicants should have a good knowledge of Inorganic Chemistry and be capable of initiating and working on research problems and the control of factory processes. Preference will be given to those having works experience and qualifications to B.Sc. standard and above. A Superannuation Scheme operates. Apply to Thorium Limited, 10, Princes Street, Westminster, S.W.1.

SITUATIONS VACANT

MINISTRY OF SUPPLY invites applications for appointment to unestablished posts in the Physical Methods Group at the Windscale Works, Division of Atomic Energy, Cumberland, in the following grades:—

- (i) **PRINCIPAL SCIENTIFIC OFFICER** (Salary Scale: £910-£1,177).

Duties: Planning and supervision of a group assisting in the commissioning of nuclear plant, and investigating technical problems arising in operations; initiation of associated development studies.

Qualifications: University degree with 1st or 2nd class honours in Mathematics, Physics, Chemistry or Electrical Engineering or equivalent qualification. Experience in organising and directing a research or industrial development group is essential. Minimum age normally 31.

- (ii) **SENIOR SCIENTIFIC OFFICER** (3 posts) (Salary Scale: £670-£860).

Duties: Responsible to a P.S.O. for directing teams engaged in the commissioning of a nuclear plant, investigating technical operation problems, or carrying out development studies.

Qualifications: University degree with 1st or 2nd class honours in Mathematics, Physics, Chemistry, Electrical Engineering or Biology, or equivalent qualification, together with research or industrial development, experience, practical experience in nuclear physics, radio chemistry, health physics or electronics is desirable. Minimum age normally 26.

- (iii) **SCIENTIFIC OFFICER** (2 posts) (Salary Scale: £380-£620).

Duties: To assist in the Physical Methods Group and to carry out development studies.

Qualifications: University degree with 1st or 2nd class honours in Physics, Chemistry, Electrical Engineering, or equivalent qualification. Above posts carry benefits under F.S.S.U.

- (iv) **SENIOR EXPERIMENTAL OFFICER** (Salary Scale: £705-£805).

Duties: To be responsible under direction for the preparation of equipment for the Physical Methods Group and the application of technique to plant operations.

Qualifications: Higher School Certificate with Mathematics or a Science subject as principal subject, or preferably a general Science degree, and several years experience in an industrial or research laboratory. Minimum age normally 35.

- (v) **EXPERIMENTAL OFFICER** (2 posts) (Salary Scale: £495-£645).

Duties: To prepare equipment for the Physical Methods Group and to assist in carrying out development studies.

Qualifications: Higher School Certificate with mathematics or a science subject as principal subject, or preferably a general Science degree. Minimum age normally 28 but applications from candidates of outstanding quality, aged 26 or 27, may be considered.

- (vi) **ASSISTANT EXPERIMENTAL OFFICER** (4 posts) (Salary Scale: £220-£460).

Duties: To assist in the duties under (v).

Qualifications: Higher School Certificate with mathematics or science as a principal subject. Grade and starting salaries according to age, experience and qualifications. Rates for women somewhat lower.

Write, quoting A291/49/BZ to Technical & Scientific Register (K), York House, Kingsway, London, W.C.2, for application forms. Closing date 20th January, 1950. 10.11A55 (100).

SITUATIONS VACANT

THE Ministry of Supply invite applications for the following appointments in the Division of Atomic Energy (Products):—

1. **DIRECTOR OF PRODUCTION.** The successful candidate will have his headquarters at Risley, near Warrington, Lancs., but will be required to make frequent visits to the factories for which he is responsible and which are situated in the North West of England. He will be responsible for the general direction, co-ordination and efficient operation of these factories which are large in size and operate complex chemical, physical and engineering processes.

Candidates must have an honours degree in chemistry, physics or engineering; they must have long experience of the management of heavy chemical or similar production plants and must understand modern methods of control by cost and technical figures, the safe operation of processes handling toxic materials, etc.

Appointment will be for five years and starting salary will depend on age, experience and qualifications, but will not be less than £1,900 a year, rising by annual increments to £2,250 a year.

2. **WORKS GENERAL MANAGER** to take complete charge of a large factory engaged in the production of Atomic Energy material. The factory is situated at Springfields, near Preston, Lancashire.

Candidates must either have an honours degree in chemistry or physics, A.R.I.C. or A.Inst.P. They must have wide experience of technical management of plants operating industrial chemical processes, of management of industrial and non-industrial staffs and of Joint Works Council Consultative machinery. They must also be familiar with modern methods of process and cost control and the organisation and co-ordination of maintenance engineering, stores and other service departments of the factory.

The appointment will be for a period of 5 years and carries a salary of £1,850 p.a.

Candidates will normally be confined to natural-born British subjects, born within the United Kingdom, or in one of the self-governing Dominions of parents similarly born.

Applications, specifying post should be addressed to Staff Section, Ministry of Supply, Division of Atomic Energy (Production), Risley, near Warrington, Lancs.

VACANCY for TRAINED ANALYST to take charge of regular chemical analyses of water samples. Salary on (provincial) scales for Assistant Experimental Officer (man, £220-£460; woman, £220-£380), or Experimental Officer (man, £495-£645; woman, £405-£520) in Scientific Civil Service, according to age, experience and qualifications. Superannuation scheme. Apply, with full details and names of two referees, to the Director, Freshwater Biological Association, Wray Castle, Ambleside, Westmorland, before 31 December, 1949.

WORKS ENGINEER required to take charge of Engineering and Maintenance Department of medium-sized Tar Distillation and Chemical Works in N.E. England. Only those with sound all-round practical training and experience in control of labour need apply. A.M.I.Mech.E. or equivalent an advantage. It would also be considered an advantage if the applicant has experience in operation and maintenance of modern steam-raising plant. Age not more than 40 years. Superannuation scheme. Write, giving full particulars of age, experience and salary required, to Works Manager, Box No. 2889, The Chemical Age, 154, Fleet Street, London, E.C.4.

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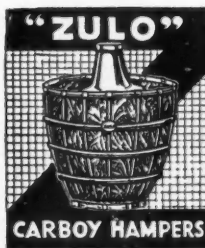
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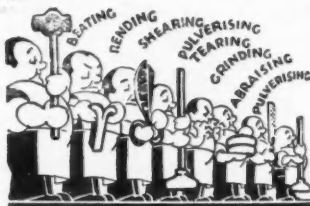
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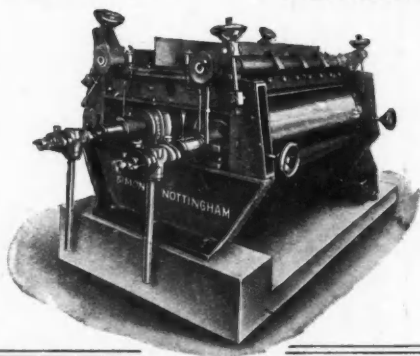
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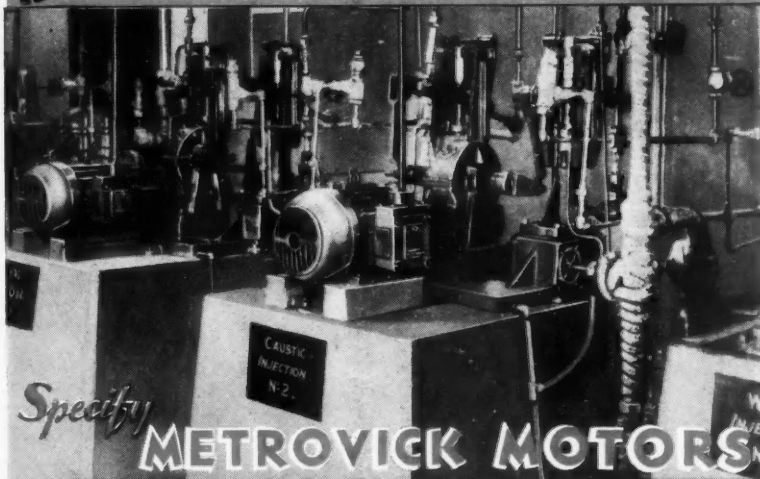
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